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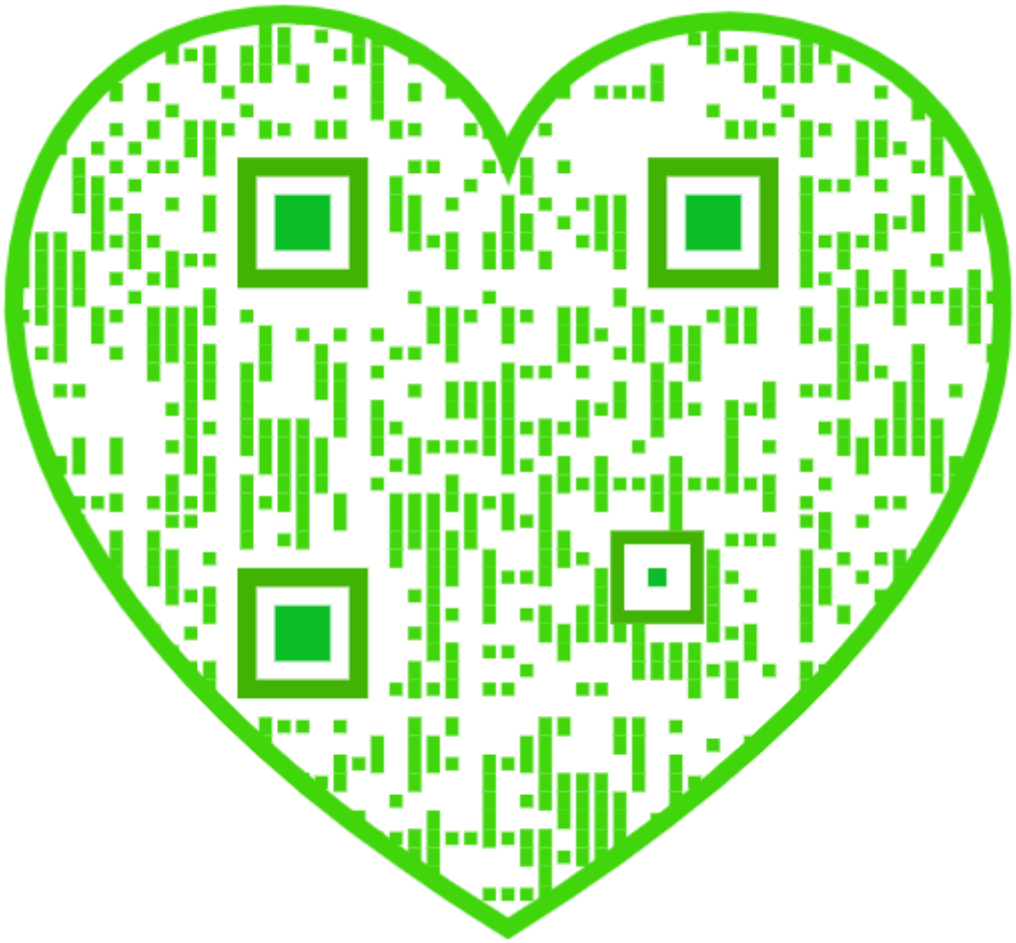
THE TANNING INDUSTRY

Prepared by

A. HEATH ONTHANK

National Shawmut Bank, Boston, Massachusetts



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THE TANNING INDUSTRY

I. Historical Introduction

SO far as it is possible to know, the process of tanning hides and skins is as old as mankind itself. The knowledge of this important trade was possessed by the ancient Egyptians, for engravings on their tombs depict the process of tanning. In China specimens of leather have been discovered with other relics which prove them to be over three thousand years old. When the European explorers came to America they found the Indians using tanned skins and hides for clothing and for their wigwams. Thus the story of the first tanner goes back beyond the ages of which history has an account.

Probably the original process of curing skins was that of simply cleaning and drying. Then the use of smoke, sour milk, various oils, and the brains of the animals themselves was found to improve the texture of the leather, and later use was made of certain astringent barks and vegetables which effected permanent changes in the texture of the skins and stopped decay. The Romans used leather which they tanned with oil, alum, and bark, but the present methods of tanning were introduced into Europe by the Moors when they conquered Spain.

The first tanners came to America with the early settlers, and there are records of the establishment of tanneries in Virginia and in Lynn, Massachusetts, as early as 1630. The growth of the industry in the new country is denoted by the fact that in 1650 there were fifty-one tanners in Massachusetts Bay Colony. The primitive methods of tanning continued in use until 1790, when the use of lime to unloosen the hair was introduced. Shortly before the Civil War the use of machinery gave the industry in this country an enormous advantage, which was increased later by the introduction of chrome tannage.

II. General Considerations

Leather may be defined as the skin of an animal, or some part of such skin, tanned, tawed, or otherwise dressed for use.

Tanning is the general term for the process which produces the chemical change in the hide or skin, resulting in the formation of leather. This chemical change takes place in the following manner: the tannin the main chemical agent which is in the vegetable tanning extract, and the gelatine of the hide have an affinity for each other, and when a complete contact is made between the two, the necessary chemical change takes place.

There are two main classes of leather:—

(1) Heavy, or "sole" leather,
(2) Light, or "upper" leather.

These classifications reflect differences of two main characteristics in the leather; first, the kind of raw material used, and second, the use to which the leather is to be put.

Heavy, or sole, leather is made from cattle hides, buffalo hides, and other thick and heavy hides. The main uses for the leather produced from these hides are:

(1) Sole leather for shoes,
(2) Belting.

Light, or upper, leather is made from several kinds of skins, the most important of which are:

(1) Calf and kip,
(2) Sheep and lamb,
(3) Goat and kid,
(4) Horse and colt,
(5) Pig,
(6) Kangaroo.

The products which result from the tanning of these skins are likewise more numerous, the main ones being:

(1) Upper leather for shoes,
(2) Glove leather,
(3) Harness leather,
(4) Upholstery leather,
(5) Bookbinding leather,
(6) Fancy leather goods.

III. Raw Materials

The source of raw materials used in the tanning industry is in truth the whole world, for products from every part of the globe have their functions in the processes of producing leather. The domestic market yields large quantities of some classes of materials, but little or nothing of other essential raw substances; the same may be said in a general way of the foreign market.

A. Domestic Sources

This country is the largest producer of beef cattle in the world, and consequently its largest producer of cattle hides. Hides and skins are really a by-product of the meat packing industry, and the number available each year depends on the demand for meat rather than on the demand for leather.

In 1909, the last year for which are available complete figures of the Census Bureau, there were taken off in this country 13,764,686 cattle hides, and there were treated by tanners the same year 20,516,332. In other words, the domestic supply of cattle hides during 1909 was 67% of the total number of hides treated. In 1914, a total of 19,726,774 cattle hides were treated. There were imported during the same year 7,743,303 cattle hides, leaving 11,983,471 hides as the product of the domestic slaughterers, or 60.7%.

It is apparent, therefore, that in spite of the enormous amount of hides produced in this country, the domestic supply will suffice for only a little more than one-half the demand.

It is well to note at this point that there are two main classes of domestic hides, viz.: "packer hides" and "country hides." The packer hides get their name from the fact that they are taken off at the slaughter houses of the meat packers, and for several reasons are differentiated from the country hides, which are taken off by country butchers, or other slaughterers. The main difference in these classes of hides is in the quality of the hide and the percentage of leather which the hide yields. The large meat packing-houses, slaughtering as they do thousands of cattle daily, keep a large force of men and boys steadily employed doing nothing but flaying. As a result they become so expert that the hides are seldom cut or mutilated. The packer hides are also kept in better condition because of better and standard methods of salting. Another advantage arising from the large take-off is that the packers can keep a wide selection of different weights and grades in stock, facilitating purchasing. Country hides, on the contrary, are apt to be cut because of poor methods of flaying, and to lack a uniform appearance. They are not always properly handled, which detracts from the amount and quality of the leather which the tanner produces. There is, furthermore, an additional expense incident to collecting these country hides from many places, and by reason of the necessary sorting and classification at the point of distribution. All these facts are reflected in the prices of the two classes of hides, packer hides usually bringing from two to four cents more per pound than country hides.

By far the larger amount of domestic hides taken off are packer hides, as the following figures will show:

1909	Number of packer hides	12,356,046	
	Number of country hides	1,406,640	
			13,762,686

The main distributing points for cattle hides are naturally in the West, and Chicago easily overtops all the other cities in the number of cattle slaughtered, and consequently in the number of hides produced. Following Chicago come in order of their importance, St. Louis, Kansas City, Omaha, Ft. Worth, St. Joseph, Sioux City, Oklahoma City, St. Paul, and Denver.

As regards the other raw materials there is a greater diversity of domestic sources of supply. This country produces a large amount of calfskins, but can by no means meet the domestic demand, as shown below:

Calf and Kip Skins, 1914

Number treated	16,067,793
Number imported	8,451,929—52.6%
Domestic supply	7,615,864—47.4%

The distributing points for domestic calfskins correspond in importance to those for cattle hides.

The domestic supply of sheepskins, large as it is, is far from enough to supply the tanners' demands, as the following figures show:

Sheep and Lamb Skins, 1914

Number treated	40,090,198
Number imported	26,535,258—66.2%
Domestic supply	13,554,940—33.8%

In the slaughter of sheep, Chicago is again the predominant market, with no close competitor. The other main distributing points are Omaha, Kansas City, St. Joseph, and St. Louis.

The domestic supply of goatskins is practically nil, and this country is almost wholly dependent on imports for that class of raw material. The following figures show the extent of this dependence:

Goat and Kid Skins, 1914

Number treated	37,755,867
Number imported	36,895,204—97.7%
Domestic supply	860,663 — 2.3%

B. Foreign Sources

Hides and skins are imported into the United States from practically every country of the earth, but in each class of imports there are certain countries which send the predominant supply. In considering these foreign sources of raw materials for the tanning industry, comparison will be made on the basis of conditions before the war, since this will show the normal course of trade.

The greatest producing district of cattle hides next to the United States is Argentina. That country ships large supplies of hides to Europe, and also supplies our tanners with the greatest portion of our imported hides. The chart on page 42 shows that in 1912 Argentina fur-

nished one-third of the total imports of hides into this country, and even under the unusual conditions now prevailing, with enormously increased hide imports, the same ratio is being supplied by this one nation.

South America is a very fertile field for cattle raising, and several others of its countries send large amounts of hides to the United States. Under normal conditions the one which leads the others is Uruguay, which ships great quantities of hides from Montevideo, and also sends many hides to Argentina to be exported from Buenos Aires. During the war Brazil has also sent large shipments of hides to this country, as have also Colombia and Venezuela.

In ordinary times Canada is the second largest source of imported hides, closely followed by Mexico. The one other large source of hides is France, and it may also be said that the French hides are of exceptionally fine quality, due to the care which the French peasants take of their cattle.

From the statistics of imports the supply of calfskins seems to be divided very equally, but these figures, though showing truly the country of shipment, do not reflect the country of origin with the same veracity. Russia is undoubtedly the greatest source of calfskins, but many of these skins are shipped out through Germany. Despite this fact, in normal times, Russia ships the largest amounts of calfskins to this country; at present the supply is entirely shut off because of an embargo on shipments of skins declared by the Russian Government.

Germany is the next largest single source of calfskins, many of which are undoubtedly Russian in origin. This supply is also shut off at present by reason of the activity of the British navy. Netherlands and France furnish large supplies of calfskins, and the extent to which the Dutch supply consists of reshipments may be seen from the drop in the volume of trade since 1914. The other countries of Europe together form another large source of supply, and South America also sends a considerable amount of calfskins.

In imports of sheepskins Great Britain has a marked ascendency over all other competitors, supplying about forty per cent of our receipts from outside sources in normal times. This trade also may safely be said to be made up largely of reshipments, since the Colonial wool and sheepskin trade is still in the hands of British agents to a large extent.

The other main countries of shipment are Argentina, Russia, and Oceania, including Australia and New Zealand. In normal times these three countries send about an equal amount of sheepskins to this country, but at present the Russian supply is cut off, and the Argentine supply, with its large German market obliterated, is flowing to the United States in unprecedented quantities.

In the foreign supply of goatskins for this country, one district again, the East Indies, has an enormous lead, amounting under normal conditions to over forty per cent of the total. A large portion of this East Indian trade is with British India. China stands second to the East Indies as a producer of goatskins, but the margin of leadership over its other competitors is slight.

A considerable supply of goatskins comes from the United Kingdom, Russia and Brazil, and as shown on the chart on page 45, their shipments are almost equal in amount. They are closely pressed, moreover, by Argentina and Africa.

C. Organization of the Domestic Market

The channels of trade by which the hides and skins reach the tanner are many and diverse in most cases. In comparison with the foreign market, however, the organization of the domestic market is very simple.

The market for packer hides is about the simplest possible. The tanners buy directly from the packers who slaughter the cattle. This is the only possible manner in which packer hides may be obtained, and the only variation in the procedure comes when the tanner buys through a broker at the primary market. This broker knows the tanner's needs, and by a personal selection of the hides, can buy for him the exact kind which his business demands. For this service the broker usually receives a fee of one-half of one per cent.

As regards country hides, the agencies which bring the hides to the tanner are more numerous, as is shown by chart on page 47. From the farmer or country butcher, who slaughters the cattle, the hides and skins may go directly to a large collector, or "hide dealer," or through a small collector to the dealer. It is the function of this hide dealer to collect, classify, and assort the wide variety of hides which he receives, and to job them out to the tanning trade. The hide dealer has in some cases grown to very large proportions, and undoubtedly his field is wide enough to allow him to expand greatly. The hide dealer usually sells direct to the tanner, but a small amount of business is also done through commission men.

The domestic sheepskin market shows a simple organization, since most of this business also is in the hands of the packers. From the slaughterer the pelts go either direct to the pullery, where the wool is removed, or go to a collector, who in turn sells to the pullery. From the puller the skins may go to the tanner in any one of three ways: first, by direct sale; second, by sale through a commission man; third, by sale to a merchant or jobber, who may assort and regrade the skins, and who jobs them out to his customers, usually small tanners.

The terms of purchase in domestic trade are very strict, due, of course, to the close hold the packers have on the market. For packer hides the terms are invariably a sight draft against the bill of lading. This is also the general practice in the purchase of country hides, with one exception where a discount of one percent for remittances within five days after receipt of the hides at the tanner's station is allowed, and a few others where a longer term of credit is allowed, but a higher price for the hides is charged, as an offset.

There is a further difference, however, in the terms of shipment. On all packer hides the goods are shipped f. o. b. Chicago, no matter what the point of origin of the hides may be. The tanner, therefore, pays the cost of transportation from Chicago to the tannery, the packer making up any difference in freight from the point of shipment to Chicago. On country hides, on the contrary, the terms are f. o. b. shipping point.

The financing of domestic purchases of hides is usually carried out through banks, the tanner giving his own note against a loan. This is the general custom, and applies wherever the tanner is entitled to a line of credit. Where this method of financing is not available to the tanner, he may use the next best way by obtaining his hides on trust receipt. This method is briefly as follows:—the tanner makes an agreement with

a bank to take up the drafts on shipments of hides, the agreement to run for a period stipulated by the bank; when the shipment of hides arrives the bank takes up the draft, thereby coming into possession of the documents attached and with them full title to the hides; the bank then allows the tanner to take the goods on a trust receipt, the title remaining in the bank, but the hides being delivered to the tanner for tanning; at the same time the tanner gives the bank his personal note payable at the termination of the period agreed upon for the amount of the value of that specific shipment of hides; this procedure is repeated on the receipt of every shipment of goods until the tanner's line of credit is used up; by that time the tanner has probably sold enough leather to be able to pay one or more of his notes, which he does, thus permitting the bank again to take up the drafts coming with new shipments. It is usually customary for the bank to renew the notes at maturity, the tanner paying the interest for the period of the note.

If neither of these methods of financing is open to the tanner, he must have recourse to borrowing from some person or firm in his own line of business. This usually is done through a leather merchant who agrees to finance the tanner's shipments of hides provided that the tanner will send his product to the merchant for marketing.

D. Organization of the Foreign Market

The organization of the foreign market for hides and skins differs to such a wide extent with each country of origin that it is practically impossible to describe exactly the course the goods will follow in reaching the tanner in this country. In general, however, the hides follow one of the courses shown by the chart on page 49.

The chart showing the organization of the European market will hold in a general way for the methods of distributing hides and skins all over the world. As is the case in the United States with country hides, the main course is for the hides to reach a hide dealer who is large enough to conduct an export trade alone or through other agencies. The trade which brings this raw material to the hide dealer is apt to be subdivided very finely. Not only do the hides come from farmers, butchers, small collectors, and through local auctions, but each one of these agencies may be multiplied two or more times, until the goods have passed through the hands of seven or eight dealers, each one exacting a profit, before they reach the hide merchant. Nor does the intervention of the middleman end here. From the merchant who collects and assorts these hides and skins to the American tanner is a long distance, only bridged by the intermediation of further auctions, commission men, or brokers, although some of the largest tanners may be in a position to buy direct. It should be emphasized that this complicated organization of the foreign hide trade does not apply to every country: the trade in continental countries usually goes by as direct a line as possible.

A word should be said in explanation of the continental auctions. These are of three kinds:

(1) local auctions.
(2) national auctions.
(3) the London auctions.

The local auctions are, as the name signifies, public sales held at various small towns and cities at which the farmers and butchers dispose of their hides to collectors or hide dealers.

The national auctions are enormous trading affairs, attracting products from whole nations, and at which the volume of business is very great. These fairs do not confine themselves to trading in any one line of commodities, and the business carried on in hides and skins is only a small part of the total. Perhaps the greatest of such national auctions is the Russian fair held at Nizhni-Novgorod. To this fair are sent goods of all sorts from all over the Russian Empire, and there is an especially large market for Russian hides and skins.

The third set of auctions, the London auctions, are in a class by themselves. These auctions are held continuously and consist of sales of imported hides almost exclusively. The hides and skins taken off in Australia, New Zealand, South Africa, and British India, come to England in large volume, due to the fact that many hide merchants of these countries are financed by English commission men. These commission men, therefore, have a hold on the goods collected in the colonies, and because there is always a ready market in London, the hides and skins are sent there for sale and reshipment.

The South American hide market presents a situation differing from other foreign markets in several respects. The one main point of difference is that the market is divided into packers, or "frigorificos," and country hide collectors, or "saladeros," similar to the market in the United States. The principal hide and skin districts are also divided on this same basis, the frigorificos being located mainly in Argentina and Uruguay, and the saladeros doing most of their business in Brazil. In general it may be said that in South America, as in this country, the packer hides dominate the market.

The saladeros collect their hides and skins in the usual manner, i. e., from the large farmers, butchers, and small collectors. After the goods are in the hands of the saladeros, however, their course to the American tanner does not differ from that of the frigorifico hides. This line of export trade corresponds in general to the methods used in other foreign countries, with the commission man playing the chief part in both cases. In a few cases large American tanners have their own buying agents in South America, but this is unusual. The course of trade in most cases is as follows:

Since the South American packers do not hold their hides for high prices preferring to realize on their product immediately, there is always a supply of hides on the market. South American commission men get a quotation from the frigorificos or saladeros, and cable an offer to their American representative, or to an American commission man with whom they trade. The American representative figures what the price will be including cost and freight or cost, insurance and freight, and on this basis quotes a price for hides to American tanners. The latter usually make a counter offer, which is cabled to South America, and after the customary dickering, the deal is closed. Shipment may be made immediately if the hides are ready to be shipped, but in many cases the hides must be salted, which takes about four weeks.

Buenos Aires is the greatest South American exporting center, drawing to it most of the hides and skins which are to be exported from Argentina and some from Uruguay. Of these exports the United States takes by far the greatest amount, except in shipments of sheepskins. Montevideo is also a large shipping point for Uruguayan hides and skins, but some of these go through Buenos Aires if the market there is

more favorable. Most of the hides are shipped dry, but recently a tendency has become noticeable to increase shipments of wet hides.

The Brazilian hide situation differs in several respects from that in Argentina. The greatest part of the hide trade is carried on through saladeros, the few frigorificos being in the southern district, and shipping through Buenos Aires as well as through Brazilian ports. The general method of doing business is through large exporting houses located in seacoast cities. These export houses finance the small collectors who gather together the skins from inland districts, by means of barter trade. This is interesting enough to deserve further explanation. The small collector trades not only in hides and skins but in everything needed to supply the needs of interior stores. He buys what he needs from a coast town merchant, and on shipping his hides and skins to a hide collector, makes arrangements with the latter to pay his bill at the coast merchant's. It is a general practice for the Brazilian hide merchant to send his goods on consignment to an American commission house, and this is true not only of Brazil but also of all South and Central American trade.

Dry South American cattle hides usually cost at least eight cents more than domestic packer hides, but this does not necessarily mean that the cost of a pound of leather obtained from domestic hides will be lower than the cost of leather from South American hides. The worth of a hide is due to the amount of leather which it will yield on being tanned. American hides come from the packer with eighteen or nineteen pounds of flesh and dirt on them for which the tanner pays, but which do not go to make up into leather; that is, there is a pure loss of this amount. South American hides, on the other hand, are given a light fleshing before they are shipped which reduces the flesh and dirt waste to about ten or twelve pounds. Of most importance, however, is the fact that most South American hides are shipped dry, whereas domestic hides are pickled, and arrive at the tannery containing many pounds of pickling liquid. The weight of this liquid is likewise an entire loss to the tanner, and is the main reason for the extra price for the imported hides. The tanner, therefore, will get several more pounds of leather out of a South American cattle hide than out of a domestic hide of the same weight. The increased yield of leather is more than enough to compensate for the higher purchase price of South American hides, and the apparent discrepancy amounts to little or nothing in the end. The above does not hold in the case of imported hides shipped in a wet condition, and their price is usually a little below that of domestic hides.

The large number of middlemen involved in carrying on South American and other foreign trade in hides and skins is noticeable, and gives rise to the question of their need. It would undoubtedly be more beneficial to the domestic tanner if some of the exporting agencies could be dispensed with, especially the services of more than one commission man. This leads to a consideration of the functions of these intermediaries and their methods of doing business.

It may be said in a general way that the American tanner knows little of the methods of importing hides, and being unable to study the question exhaustively because of pressure of other business, is content to leave the dealing entirely in the hands of a commission man. This often results in the tanner being treated harshly if he happens to fall into the hands of an unscrupulous dealer.

The natural tendency of a commission man is to use his excess capital in merchandising, or outright buying and selling of hides if a favorable opportunity presents itself. This is the case in the South American trade to a great extent, and is a wholly legitimate method of trading if not abused, since the usual commissions of one-half of one per cent to two per cent will not result in extraordinary profits. The commission merchant may use his situation, however, to advance his own interests at the expense of his customer, by manipulating the purchases, exchange, or weights.

The financing of foreign shipments of hides resembles in its general features the financing of domestic shipments, that is, it is done

(1) by cash payment,
(2) by the buyer authorizing the seller to draw a draft against him with documents attached,
(3) by establishing a letter of credit through a national or private bank, or trust company,
(4) by conducting a similar arrangement through a leather merchant or commission house.

The usual methods of settling for a shipment of hides by cash payment are to remit by cable, or to purchase a bill of exchange which is sent to the shipper.

In the second method of financing imports the American buyer notifies the shipper to draw his draft against him. The shipper, therefore, having shipped his merchandise, presents a draft against the purchaser with documents attached to his bank, which may pay him immediately the face value of the draft minus interest and commission, or may wait until the draft is collected before paying him this sum. The foreign bank then sends the draft to its American correspondent, which acts purely as a collection agent. It presents the draft to the purchaser, who accepts it, receiving therefor the shipping documents attached. At the end of the period stipulated, the draft matures and is taken up by the purchaser.

The third method, which is the one used most commonly, is carried out through a national or private bank, or trust company. The purchaser opens a letter of credit at his American bank for an amount to cover fully the amount of his purchase of hides, and authorizes the shipper to draw on this bank. The shipper receives his money immediately after shipment as explained above, and the draft with documents attached, on arrival in this country, is accepted by and becomes an obligation of the purchaser's bank. This bank then allows the purchaser to obtain possession of and carry into the tanning processes this shipment of hides, requiring, however, that these specific hides shall be identifiable at any time, and also retaining full title to the ownership of the hides. This letter of credit is granted, where the purchaser is entitled to such a line of credit, for a period up to six months, and is renewable in some cases. Letters of credit run for a differing length of time depending on the country of origin, the general terms of credit being:

(1) To South American countries—90 days;
(2) to Far Eastern countries—4 months;
(3) to European countries—4 to 6 months.

Where the purchaser's credit does not permit him to make use of a letter of credit, the tanner must go to a domestic leather merchant or

commission house for aid in financing his shipments. In this case the merchant will take up the shipper's draft which is made out against him, and will deliver the merchandise to the tanner only on condition that he is able to pay for it. If the tanner is unable to do this, the merchant places the hides in a warehouse, delivering them in whole or in lots as the tanner makes payment. In carrying out this method, it is customary for the merchant or commission man to conduct his foreign payments by opening a letter of credit at a bank, as explained above, which his credit standing will allow him to do.

No definite rule can be laid down concerning the terms of purchase, since they differ with each individual purchase, and are covered in the quotation of the price per pound which the commission man makes to the tanner. Shipments may be made f. o. b. shipping point, in which case the tanner pays the insurance and freight separately, or may be made f. o. b. point of import, in which case the insurance and freight are figured into the price of hides quoted.

E. Tanning Materials

Many kinds and classes of materials are used by tanners to transform the hides into the finished product, leather. The scope of this report does not permit an enumeration in full of these materials, or an explanation of their uses, but it is necessary to touch upon the most important of these, viz. the tanning extracts.

Tannin, or tannic acid, which is the active transforming agent, is abundantly found in a very large number of plants, and there are, in consequence, a great number of tannins. They all have the common properties of being astringent and drawing together the tissues, of forming insoluble compounds with gelatine or gelatinous tissue, and of being soluble in water to a greater or less extent. There are two general classes of tannins:

(1) pyrogallols, which make a light-colored leather, not as harsh as the other classes of leather, and which decompose, yielding ellagic acid which has waterproofing qualities and gives weight;

(2) catechols, which are darker in color and yield reds and tannin anhydrides which deposit in or on the leather. The tannins of each class which are most generally used in this country are as follows:—

Pyrogallols

1. Chestnut wood; which comes on the market in the form of crude and decolorized liquid extracts. It contains 25% to 31% of tannin.

2. Oak wood; also a liquid extract similar to the chestnut, containing 24% to 27% of tannin.

3. Myrobalans; which is the fruit of an East Indian tree, containing 27% to 38% of tannin, and producing a very light-colored leather.

4. Sumach; the ground leaves of a Sicilian plant, containing about 28% of tannin, and producing a nearly white and very beautiful leather. It is used solely for tanning the best moroccos and the finer leather.

5. Divi-divi; the dried seeds of an Indian tree, containing 40% to 45% of tannin, and yielding a white leather.

Catechols

1. Hemlock; which reaches the market as bark or as a liquid extract, contains 25% of tannin, and yields a dark red leather.

2. Quebracho; a tree which grows only in the southern part of South America, chiefly in Argentina and Uruguay. It reaches the market as a liquid of from 25% to 35% tannin, or as a solid containing about 65% of tannin. It is rather harsh and yields a light red tannage.

3. Mangrove; coming either as bark or a liquid from Africa, and containing 60% tannin.

4. Gambier; the product of a Singapore shrub, generally used as a preparation for coloring or in combination with other tannins.

In addition there are two other very important tanning materials which do not fall into either of the above classifications, viz:

1. Oak bark; the bark of the white oak tree, yielding 12% to 14% tannin, and producing the best leather known.

2. Valonia; the ground acorn cups of the Turkish and Greek oaks, containing 32% to 36% tannin, and yielding a tough but firm leather.

This list does not pretend to include every kind of tanning material, but only those vegetable agents most commonly used by domestic tanners. In addition there are two mineral tanning agents in general use, (1) bichromate of potash or bichromate of soda, and (2) alum.

Tanners usually purchase these tanning materials by contracting for a year's supply from the extract dealers or from the importers. The supply of quebracho is almost entirely in the hands of a single concern, but the market is open on other materials.

IV. Tanning

Like most other industries, tanning does not produce a uniform, standardized product. Certain classes and grades of leather are produced, but within those grades the differences may be very wide, due to the fact that the methods of no two tanners are absolutely alike. In any description of the methods of producing leather, therefore, it must be borne in mind that the explanation reflects the general conditions only, and that to describe in detail every process would be to describe the details of every tannery in the country.

A. Sole Leather

There are four principal tannages of sole leather:

(1) oak,
(2) union,
(3) hemlock,
(4) chrome.

The name of the tannage, however, does not mean that only that specific kind of extract is used. An oak tannage, for instance, is made up of a certain amount of oak extract or bark, but contains other extracts, such as chestnut, and indeed, this tannage is characterized chiefly by the light color of the leather produced rather than by the content of the tanning extract. Union tannage derives its name from the fact that the extract is a mixture of oak, chestnut, and hemlock. Quebracho may also be used in some of the processes of the vegetable tanning.

The proportion of each of the classes used may be obtained from the figures of the Census Bureau for 1914, and the following table will show the extent of the use of each class of tanning, with a comparison with the figures for 1909 and 1899:

	1899		1909		1914	
	Sides	%	Sides	%	Sides	%
Total	15,472,072		17,805,252		18,075,482	
Hemlock	9,810,996	63.42	7,963,728	44.7	5,626,696	31.3
Union	3,096,162	20.01	5,756,227	32.3	6,588,799	36.4
Oak	2,562,814	16.56	3,805,861	21.4	5,267,936	29.1
Chrome	2,100	0.01	279,436	1.6	592,051	3.2

It is apparent that hemlock tannage is decreasing both actually and relatively, with a corresponding increase of oak and union tannage. This is in part due to the limitation of the supply of hemlock bark; originally the United States had apparently unlimited supplies of hemlock bark, but it has been cleaned up to a large extent in recent years. The use of chrome tannage appears to have spread, but can not be said to cut much of a figure in the sole leather business even now. The reasons for this will be considered later.

1. Vegetable Tanning Process

As has been stated above, tanning processes are by no means the same in every tannery. In a description of the methods of transforming hides and skins into leather, therefore, the processes must be regarded as typical of a general class rather than as being standardized and uniformly used.

Hides are received at the tannery in any one of four different conditions:

(1) "green," or "fresh," direct from the slaughter house,
(2) wet salted,
(3) dry salted,
(4) sun-dried, or "flint" hides.

The first tannery operation, therefore, is to wash and clean the hides and to bring them back as nearly as possible to the flaccid condition in which they left the animal's back. This is accomplished by two processes. When ready to be sent through the tannery the hides are first put in a huge drum about twelve feet in diameter, containing water, called a "soak-wheel," which is revolved rapidly for thirty minutes. This has the effect of removing much of the salt and softening the hides. The hides then go directly to soak vats, which are pits into which the hides are laid flat, and are then filled with water. Here the hides remain for two days for the purposes of (1) softening them further by swelling and opening up the fibres as much as possible, (2) removing any other putrefactive refuse and dirt.

The next process is that of depilation, or unhairing. Before the hair is actually taken off, the skin must be prepared by an operation of liming, for the purpose of loosening the hairs in their follicles, so that they may be removed more easily. From the soak vats, therefore, the skins go to the lime vats, being first suspended in a weak lime solution for one day to prepare them for the other liming. For four more days the hides are limed, being placed in a stronger solution each day, which on the fourth day is heated and kept at 76° F. After passing through the liming vats the hides are unhaired immediately in an unhairing machine, which removes the hair by means of revolving spiral knives.

The flesh which has remained on the hide is removed at this point by a fleshing machine which scrapes off practically all the extraneous matter. The hides are then washed in a paddle wheel and go to the trimmers, who lay them on beams and complete the fleshing by trimming the flesh off the edges which the fleshing machine has not reached. From the trimming beams the hides go to a graining table where any short hairs remaining are scraped off with knives.

The hides are now ready to take the tanning extracts except for the fact that they contain lime which would prevent the tannic acid from taking effect. The hides are placed in a paddle wheel containing water, therefore, and paddled for twenty minutes or so, for the purpose of removing the lime.

One result of the unhairing and fleshing processes has been to squeeze out some of the lime and water which have filled the hide fibres, an undesirable loss of weight in hide substance. To bring the hides back into a plump condition in which they will be fit to take the tanning liquors, therefore, they are placed in vats of water—"cold pools"—and kept there overnight. The hides are suspended on frames which

are kept agitated by a system of mechanical rockers, in order that the water will touch all parts of the hide.

The processes described above have been carried on in what is known as the Beam House; the hides now go to the Yard, and come for the first time into contact with the tanning liquors. As in the cold pools the hides are suspended in vats on poles which are kept agitated by rockers. These vats are built in the form of twenty to a section, the vats of every section having a connection with each other by pipes. The hides remain suspended in these pits for eighteen days, a stronger liquor being pressed over them each day in the following manner:—the hides from the cold pools are placed in the tail rocker pit, next to the pit holding the weakest liquor. This weak liquor is then allowed to run through the connecting pipe into the vat containing the fresh hides; similarly the next strongest liquor is pressed over the hides which have been suspended one day, and so on, until the vat which has contained hides for seventeen days—the "head rocker"—receives the newest and strongest liquor. It is seen, therefore, that every day the liquor is pumped one vat further along, until it reaches the tail rocker, where it has lost much of its strength, and is fit to press over new hides.

The hides then go to the press layers, pits in which they are laid down flat on top of one another, where they remain for twenty days. Bark is sprinkled between the hides as they are laid into the vats, and the liquor is stronger than in the rockers. The vats are in sections similar to the rocker pits, except that there are only ten vats per section, and the liquor is changed every other day instead of every day as in the rockers.

The next two processes, called the "first layer" and the "second layer," correspond closely to the operation of the press layers. The hides are laid away, bark being sprinkled between them in both layers, remaining in the first layer for seven days, in the second layer for twelve days. The liquor of the first layer is stronger than that which is pressed over the head rocker hides, and the liquor of the second layer is stronger than that of the first layer; both liquors remain in the vats unchanged for the full time the hides remain there.

On coming out of the second layer the bellies of the hides are cropped off, leaving what are called "backs," which form the best portions of the hide. The backs and bellies then go into a third layer, where they stay for thirty-four days. They are laid down flat as in the other layers, backs on the bottom and bellies on top, and no bark is sprinkled between them. The liquor is again stronger, and in order to increase the strength quebracho may be introduced at this point. When the backs come out of this last layer they are split down the middle or line of the backbone, forming two backs. The hide is now in four pieces, two backs and two bellies.

The backs and bellies now go to a bath of hot water, or "hot pool," where they remain for fifteen or twenty minutes, for the purpose of clearing out and cleaning off the sediment accumulated in the layers. Thence they go to the extract wringer, which is a simple wringer, through which the hides are run to squeeze out the liquor and dry the hides sufficiently to permit them to take up the extract in the next operation. The following process consists in placing the hides in a large drum, similar to the soak wheel in the first operation, into which is run a very concentrated extract, at a temperature of 150° F., and to the amount of twenty-five per cent of the weight of the hides. The drum is revolved,

"milling" the hides, for an hour and a half, resulting in adding considerable weight to the stock.

From the extract wheels the hides go to the tempering vats, which contain a fairly strong mixture of quebracho or other extract, where they remain for four days, for the purpose of setting the extract absorbed in the extract wheel. The liquor increases in strength while the hides are in it, because the extract absorbed in the wheel is so much stronger than that in the tempering vats.

When the extract has been set in this manner the hides are bleached. They are hung on frames which are fixed over a series of five baths containing the following liquids at a temperature 126 F. except the fifth;

(1) hot water,
(2) solution of soda in water,
(3) a 2% solution of sulphuric acid,
(4) a 1.5% solution of sulphuric acid,
(5) cold water.

The stock is lowered into each of these baths in succession for seven minutes at a time, coming out with a clear, light color.

From the bleach the backs and bellies go to another wringer—the "oil wringer"—where they are again wrung dry to make room for the oil to be absorbed in the next operation. This latter consists of milling in a drum, called an "oil wheel," which contains mineral oil, sugar and salts. The bellies are milled for twenty minutes, the backs for thirty minutes, for the purpose of giving color, weight, and pliability.

The stock is then hung up in a room overnight to dry, to allow the oil to soak in. No circulation of air is permitted in this room, as it would destroy the result aimed for. The next morning the stock is "set out" by being run through a machine which smooths the grain by pressure of a revolving cylinder. After setting out, the stock is dried until it is bone dry in rooms in which currents of hot air are circulated; this takes five or six days. After being thoroughly dried the stock is dipped in a solution of sugar and salts to add weight, piled under a cover over night and set out again, or "reset," the next day.

At this point some of the backs are divided into shoulders and bends, the latter being the most desirable portion of the hide, and the treatment of the bends and shoulders differs. The bends are piled over night, and the next morning are sponged and rolled out under rollers which exert great pressure, making the leather compact and smooth. They are then dried for six or seven hours, piled over night again, and rerolled the next morning. The shoulders, bellies and backs after being reset are hung up over night, and are sponged and rolled the next afternoon; following this they are piled up over night, and given a second rolling the next morning.

After rolling, bends, backs, bellies, and shoulders are all given a "finish dry" of four days for bends, backs, and shoulders, and three days for bellies. They are then washed on the grain, dried, brushed up to get a glossy surface, and are ready for shipment.

The most noticeable part of this process is the extraordinary length of time necessary to turn out hides as the finished product. The time required for tannery operations alone is from four to five months, and if a two or three months' supply of hides is kept on hand, as is the case in most tanneries, this time also must be added to the period between

purchase of material and shipment of product. Considering an additional period of credit to the buyer of one or two months, the total time between purchase of material and receipt of money for the finished product mounts up to between seven and ten months.

2. Chrome Tanning Process

It was with the object of diminishing the time necessary to tan hides that the chrome tannage was adopted. Chrome tanning consumes only a few days as compared to months required by the older method, and it produces a leather which is soft and pliable, of close texture, and resistant to water.

Chrome tannage differs from vegetable tannage in not producing a complete chemical change in the fibre of the hide. It consists of a partial chemical combination between the hide fibre and the chrome salts, and a partial mechanical deposition of chrome oxide in and on the fibres, which are plated with chrome, whereas in vegetable tanning the interstices are filled up with vegetable extract. To make the chrome tanned hide flexible oil is worked into the interstices to take the place of the extract.

The preparation for tanning, or beam shop work, is much the same for chrome tanning as for vegetable tanning, and need not be explained further. After fleshing the hides are washed for the purpose of removing any surplus lime. They are then put through a process called "bating" which has for its object the smoothing and toughening of the grain. This consists of paddling the hides in a mixture of a chemical deliming agent together with a bacterial agent at a temperature of 90 F. for one to two hours. This chemically neutralizes the lime, rendering it soluble, and depletes the grain of the hide to the required degree. The hides are then "pickled" in a mixture of sulphuric acid and salt, which acts as a preservative, keeping the hides from putrefaction, and acting as a preparation for the chrome tannage.

The tannage operation itself is what is known as the "one-bath" process. The hides are paddled for forty-eight hours or more in a solution of bichromate of soda or potash, muriatic acid, and a reducing agent of glucose, sugar, or flour, which together form a basic chrome sulphate. The length of time for paddling the hides depends primarily on their weight, heavier hides requiring a longer treatment, but the one essential is that the hides shall be thoroughly struck through with the tanning liquor. After this process, the goods are laid in a pile for three or four days, to allow the chrome to be fixed in the fibre. They are then drummed in a solution of some alkaline carbonate to neutralize the acid and remove any excess. Following this the hides are tacked out on frames, given a coat of oil to finish off the grain and increase the pliability and are dried until they are bone dry, which takes at least three or four days. The chrome tanning processes are now finished and most chrome sole leather is sold in this state.

It is desirable in some cases, however, to have a heavier and sturdier product, and in such instances the chrome leather is sent through one additional process. After drying, the leather is immersed in a bath of molten wax and resin, or other material, which is heated to a temperature of 160 to 180 F. and left until entirely saturated. It is then dried again and is ready for shipment. This extra process fills out the interstices between the fibre, and corresponds to the stuffing of oil and salts given to vegetable extract leathers.

In spite of the great advantage of chrome tannage in shortening the time for the tanning processes, thereby releasing the tanner's working capital many more times a year, there are certain disadvantages which are responsible for the proportionately small amount of chrome sole leather tanned. Perhaps the largest factor determining the amount of chrome leather manufactured is the demand. The slower processes of vegetable tannage have always been and still are considered to result in superior leather, which is in demand for all branches of sole leather manufactures. These opinions are backed up with certain facts which make vegetable tanned sole leather more desirable. This leather, for instance, is said to be easier on the foot of the wearer when it is in shoes, is a better non-conductor of heat and cold, and is thicker than chrome leather. The latter, however, is said to be a better non-conductor of water, and to be more durable. The advantages of vegetable tanned sole leather, however, so far outweigh the advantages of the chrome that it will probably always be used to a far greater extent, except in cases where great tensile strength is needed.

It should be understood that all tanning of sole leather is for stock, with the exception of one general class of the business to be noted later. This is possible because the product is practically uniform and can be readily disposed of at any time during the year.

B. Upper Leather

There is a greater diversity in methods of upper leather tanning than in sole leather tanning, due to several reasons. In the first place, the product is more varied than in sole leather tanneries because of the wider range of uses to which upper leather may be put. It is customary for upper leather tanneries to specialize on making certain classes and grades of upper leather. This tendency to specialize in product is furthered by the larger number of kinds of raw material which may be used in tanning upper leather, e. g. calfskins, sheepskins, goatskins, etc., whereas, sole leather tanneries are confined to one general kind of raw material, e. g., cattle hides. This results in tanneries concentrating on one or two of these classes of raw material instead of trying to cover the whole field. A third tendency which makes for specialization is the possibility of using more than one kind of tannage, but it is not usual for the average sized tanner to tan with more than one kind. In short, then, the upper leather field is one of specialized tanneries because

(1) it is preferable to concentrate on one class of product,

(2) this class of product is obtainable only by use of one kind of raw material,

(3) this class of product and this grade of raw material are best tanned by one kind of tannage rather than by several kinds.

There is one exception to these reasons for specialization. It is stated that the general practice is to choose the class of raw material and the kind of tannage which will best turn out the grade of product desired. Some tanners, however, prefer not to insist on the class of raw material being uniform, but will take any material which they can get, producing several grades of products, and adapting the tannage to that end.

There are three classes of tannages for upper leather in general use:—
(1) vegetable,
(2) chemical,
(3) retan.

Under these generic headings is a multitude of kinds of tanning agents, most of which have been described briefly supra. The principal tannages of each class are:

(1) Vegetable:
  (a) oak,
  (b) hemlock,
  (c) sumach,
  (d) quebracho.
(2) Chemical:
  (a) chrome,
  (b) alum,
(3) Retan.

Of these tannages chrome is by far the most predominately used, an estimate placing chrome upper leather as sixty per cent of the total upper leather tanned.

Of the vegetable tannages, the oak and the hemlock processes correspond closely to the processes used in tanning sole leather, and require no further description. The sumach tannage produces a pliable, soft, almost white leather, used largely for shoe linings, but it is not of great importance in upper leather tanning. It must be remembered that in upper leather tanning, as in sole leather tanning, methods of individual tanneries differ greatly.

Since sheepskins are the only skins which reach the tanner already unhaired, the first operation in the great majority of cases in upper leather tanning is that of unhairing. For this there are two processes available, viz. (1) the lime process, as described above for sole leather, and (2) the sulphide of sodium process. In the latter the skins are placed in vats containing a solution of this chemical, which dissolves the hair.

There are two processes used in tanning upper leather by a chrome tannage, one of which, the one-bath process, is similar to that described for chrome sole leather. The second process, or "two-bath process," is used mainly for goatskins. Up to the actual process of tanning it is like the one-bath process, except that for all upper leather the operation of bating is performed more thoroughly.

In the two-bath process the skins are then paddled or milled in a drum containing a solution of bichromate of soda or potash and muriatic acid until they are struck through, which consumes from one to four hours, depending on the heaviness of the skins. They are next placed in the second bath, consisting of a solution of hyposulphite of soda, and paddled for about a half day, which serves to reduce the chromic oxide and fix it in the fibres.

The skins are then washed, shaved, and are ready for coloring. This is accomplished by revolving them in a drum containing the dye for a period varying from one-half hour to one hour, depending on the strength of the color desired. They are next sorted and fat liquored, i. e., revolved in a drum containing an emulsion of oil and soap, which restores a certain amount of natural oil to the skins, rendering them more soft and pliable. They are then washed again and run through

putting out machines, which takes the stretch out of the skins. At this point they are dried for the first time, and since they are sold by the square foot it is necessary to obtain as much area as possible. For this reason the skins are tacked to wooden frames, so that in drying the shrinkage will be reduced to a minimum.

At the end of this drying the skins are hard and stiff, and must be made pliable, which is accomplished by the "staking out" process. The skins are first seasoned with a solution which fills out the grain, and after drying again are "machine staked," i.e., put through a machine which pulls the skins first one way and then another, serving to make them soft. The skins are then "rolled" under a circular wheel on which there is great pressure, which smooths out the skin and frees it of wrinkles. If the skins have been dyed black, they are "glazed," i.e., given a shiny finish, or they may be "embossed," i.e., treated by a machine with engraved rollers which brings out the grain. They are then run through an almost human machine which measures the number of square feet of the skin, are bundled, and are ready for shipment.

Sheepskins arrive at the tannery from the pullery already unhaired and "pickled," i.e., treated with a liquor containing one per cent of sulphuric acid and seven per cent of salt, for preservative purposes. They are first sorted into grades according to the kinds of leather into which they are to be made, are rinsed to take out the pickling liquor, and are then pressed in a hydraulic press for three to four hours under a weight of seventy-five to one hundred and fifty tons, for the purpose of removing the grease and dirt. This process causes the skins to be pressed together into large cakes, and to separate them they are placed in drums, or "pin wheels," which are revolved rapidly until the skins are separated. Following this the skins are run through a fleshing machine and are then ready for any one of the tanning processes.

Skins tanned in sumach follow the usual course of the preliminary operations and are then hung in vats containing the sumach liquor for a period of six days. On removal they are thoroughly dried, and pass through the other processes of coloring, drying, staking, rolling, glazing, and measuring as described above.

The alum tannage and the quebracho tannage are very much the same as the chrome processes in that the actual tanning is accomplished by revolving the skins in a drum containing the tanning liquor. The time for milling is about one hour for the alum tannage, but is increased to seven hours when quebracho is the tanning agent. The remaining processes are practically the same as in chrome tannage, except that one additional operation is sometimes added to increase the pliability, viz. "knee staking." This consists of pulling the skins over a rounded steel edge, using the knee to get a good leverage.

Calfskins and cattle hides which are tanned in vegetable extract or in chrome are often split for use as upper leather. This operation is usually inserted just before the hides are to be tanned; after an inspection and sorting the hides are sent through a machine which splits the hides into two layers, the correct thickness being taken off the top, or "grain" side. Following another inspection to see that the grain splits are uniform in thickness and quality the splits go to the tanning drums or vats.

There is one other general class of tannage used, known as retan. This is, as its name indicates, a double tanning, consisting of a primary chrome tannage followed by a vegetable extract tannage.

C. Patent Leather

When it is desirable to make the tanned skins into patent leather, it is necessary that some of the grease be taken out of the skins in order that the finish may get a good hold on the grain of the skin so that it will not peel off in wearing. This process, known as "degreasing," is accomplished by hanging the skins in large tanks and giving them a naptha bath varying in length according to the nature of the skins and the process used in tanning.

The skins after degreasing are ready for the patent leather process, or "japanning." They are first laced by ropes to large wooden frames and pulled absolutely taut. The next operation is to apply evenly a daub coat consisting of a preparation of linseed oil, collodion, amylacetate and a color, which furnishes a foundation for the coat of japan and prevents it from striking through the grain and fibres of the skin. The treated skins are then dried in the sun for about six hours, following which they are rubbed down lightly with pumice to remove dust imperfections and smooth the coat. A second daub coat, drying and pumicing is given in most cases, and the skins then go to the finishing room to be japanned. This process consists in giving the hides or skins a coat of varnish of which linseed oil reduced with turpentine is the chief ingredient. This coat is dried on by placing the frames to which the skins are lashed in ovens heated to 140 F. for twelve to twenty-four hours. This is followed by another sunning of from six to eight hours to complete the process.

Under normal conditions it takes from two to three weeks for any one lot of skins to work through the japannery. This same lot has been in the tannery, on the average, from four to five weeks, so that about seven weeks elapse since the skins were started through the tannery processes until the time they are ready to ship to the buyer.

Patent leather, like all other upper or light leather, is sold by the square foot. This is true also of chrome sole leather, which is an exception to the rule, as all other sole leather is sold by the pound.

Japanned leather, or as it is more commonly known, patent leather, was formerly manufactured under a patent, whence it receives its name. The basic patents have now expired, however, and the right to produce this class of leather is open to any person.

D. Amount of Product

The rapid increase of production of leather in this country is shown clearly by the chart on page 51. From a product valued at $157,237,597 in 1869, the production rose to $367,201,708 in 1914. It is noteworthy, also, that practically all of this increase occurred within the past twenty-five years, and that the increase since 1899 has been 81.7%.

Sole leather is easily the most valuable class of leather produced, with upper leather a good second. The table below will show the relative value of each class of leather manufactured in 1914:

Class	Value	%
Total	$341,796,436	100.0
Sole leather	116,188,059	33.9
Upper leather	85,051,550	24.9
Cattle side upper	32,939,139	9.6
Harness leather	20,969,169	6.1
Patent leather	15,590,812	4.5
Upholstery leather	14,328,358	4.2
Fancy leather	8,775,968	2.5
Belting	8,369,584	2.4

Of the upper leather tanned the largest amount is of calfskins, as the following table will show:

Upper Leather, Total	$ 85,051,550	100.0%
Calf and Kip	41,812,734	49.2%
Goat and Kid	26,113,234	30.7%
Sheep and Lamb	10,885,175	12.8%
Cabretta, Kangaroo, etc.	4,198,017	4.9%
All other	2,042,390	2.4%

E. Contract Tanning

There is one large class of tanning which has not yet been mentioned — tanning on contract. This grade of work amounted to $25,405,272 in 1914, or 6.9% of the total value of leather products for that year, and an increase of almost 19% over the figures for 1909. It is easily seen, therefore, that a class of work of such importance deserves special attention.

The nature of contract tanning is well indicated by its name: the tanner operates his tannery under a contract from another person, who supplies the raw material, and disposes of the leather. The tanner's function is merely to tan all the hides or skins which come to him, for which he receives a certain commission.

Tanners who do work on contract are obviously those who are not able to finance themselves sufficiently, and who, rather than to meet a

loss because of fixed charges, will place their tanneries at the disposal of some leather merchant or other person who has skins which he desires to have tanned. This condition may not always obtain with a tanner, and it may be that he will tan for a commission only until he can finance his own purchases and sales, or during periods of depression when it is difficult to find a market for his goods through his own agencies. Taking on this business is usually not from choice but from necessity, and the contract tanner, like the small boy, is hopefully awaiting the time when he will grow up and be self-supporting.

This relation of contract tanning to the financial condition of the tanner is paralleled by the relation to the size of the tanner. The tanner who works on contract is usually the owner of a small tannery, such a one, for instance, as would tan a hundred cattle hides a day, or a corresponding number of skins. The small size of a tannery is a fundamental reason for the tanner receiving a fixed price per hide instead of financing his entire business.

A third relation which bears on this problem is the tendency of shoe manufacturers and other producers of leather manufactures to integrate. Having a plentitude of capital, they are likely to buy up a shipment of skins or hides, have them tanned on contract, and take the finished product for their own use. This inclination to integrate is increasingly noticeable, and is responsible in many cases for the continuance of tanners who do their work on contract.

F. Costs

It is difficult to make any statement concerning the costs of tanning which will adequately cover the subject, as it will be realized that practices of individual tanneries differ widely, and with them, the costs. In sole leather tanneries using vegetable extracts, the proportions of costs may be said to be close to the following:

Raw Material Cost	70%
Tanning Cost	25%
Labor Cost	05%

For upper leather tanneries it would be almost impossible and useless to attempt to lay down definite percentages of costs, for several reasons. As has been pointed out already, no two tanneries make exactly the same kind and grade of product. The methods of tanning, furthermore, are so diverse, and the tanning extracts used are so varied, that it would be impracticable to average costs on these different bases. And lastly, the raw material may be of several different classes, and from every quarter of the globe, which has a wide effect on costs. It would be the part of discretion, therefore, not to set down any ratio of costs for upper leather tanneries.

G. Tanneries

The number of establishments tanning hides and skins in this country has shown a steady decrease, according to figures of the Census Bureau.

This will be shown by the following table:

Year	No. of Establ.	No. of Wage Earners	No. of Wage Earners per Estab.
1869	7,569		
1879	5,628		
1889	1,787		
1899	1,306	52,109	47.5
1904	1,049	57,239	54.6
1909	919	62,202	67.7
1914	740		

It is apparent that the tendency is to decrease the number of establishments and to increase their size. This may be attributed to two main causes:

(1) Magnitude of the operations.
(2) Integration by packers and leather goods manufacturers.

The description of the processes necessary in tanning hides given above shows, more than anything else, that tanning is a big as well as a long operation. The necessity for a large amount of capital with which to finance the purchase of hides and skins, their passage through the tannery, and the sale of leather betokens that only a business conducted on a broad scale can survive the competition, unless it resorts to contract tanning. With the growth of enormous tanning concerns this need of enlarged tannery operations has become more and more apparent, until at the present time it may be said that the "small tanner" of a few generations ago is non-existent, except as a commission tanner.

This growth in size may be laid to the tendency of packers and manufacturers of leather products to integrate as much as to the general tendency towards enlarged units of business. Some time ago several of the largest packers sought to provide an outlet for the hides and skins which are the by-products of their trade by getting control of certain tanneries. The result was to bring this large force into the leather market as well as into the hide market, and to provide another power urging large scale production. Recently this same desire to integrate further has been manifested by the packers, as a result of which several more independent tanneries have been brought under their control.

The inclination to integrate has also been evident on the part of shoe manufacturers and other producers of leather products who have wished to control their raw material supply. This has taken two forms, contract tanning and entire control of tanneries, usually those of a medium or large size.

Thus the independent tanner is being squeezed from two sides, by the large scale production and competition of the packers' subsidiaries, and by the cutting off of his market by reason of integration by manufacturers of leather products.

Geographical Distribution

Pennsylvania, Massachusetts, New York, and New Jersey easily overtop all other states in the number of tanneries located there. (See Appendix B.) When the number of tanneries is compared to the value of product by states, however, a different aspect of the situation is presented. Pennsylvania, for instance, with 163 establishments produced over seventy-seven million dollars worth of leather in 1914. Massachusetts, with 132 establishments, produced only forty million dollars worth of leather, whereas Wisconsin, on the contrary, with but 32 establishments, produced forty-four million dollars worth of leather.

This throws a light on the size of the establishments in the various states, and also on the class of product manufactured. The largest tanneries are liable to be producers of sole leather, a tendency which is truly reflected in Pennsylvania, which is the greatest sole leather district in the country. The western states are, as a rule, larger producers of sole leather, whereas the eastern states, being near the points of importation, tend to specialize in upper leather.

Pennsylvania has no near competitor to dispute her title of largest leather producing state in the country, putting out 23.8% of the total value of leather produced. Wisconsin and Massachusetts were running a close race for second place, with no other states very close, as shown by the chart on page 52, together with the other states which are large producers of leather.

Location of Tannery

There are certain conditions affecting the location of a tannery which are worthy of mention.

The necessity for locating a tannery near the source of bark supply is not as strong now as it was a generation ago. The prime need of such a location at that time is reflected in the great number of tanneries in Pennsylvania, which was formerly the largest source of hemlock bark, and also in the tanneries located in the South, which is the region supplying most of the chestnut wood and oak bark. With the introduction of quebracho, chrome, and alum tannage, and with the increased use of extracts of the bark instead of the bark itself, the necessity for proximity to the bark supply does not figure greatly.

Probably the most important consideration in the location of a tannery at the present time is that it should be placed where the supply of hides or skins necessary for the class of leather which it produces shall be readily available. This means that a tannery using imported skins may find its best location near the coast, in order to save freight charges to inland points. The same applies to the use of domestic hides and skins, for every section of the country produces hides peculiar to itself and whose characteristics are more or less better adapted for one purpose than for another. Southern hides, for example, are best adapted for light harness leather and some grades of shoe leather, and any tannery producing such kinds of leather would naturally find its best location in the South, so far as its supply of raw material is concerned.

A second very important consideration affecting the location of a tannery is the market for that particular class of leather which the tannery produces. The greatest shoe district of the country, for instance, is in eastern Massachusetts, which makes Massachusetts, or at any rate, the East, a desirable location for sole and upper shoe leather tanneries. This applies in equal measure to the location of tanneries near other shoe manufacturing districts, glove making districts, or any district in which leather products are manufactured in large amounts.

A third consideration is the quantity and quality of the labor supply available in the town or city in which it is planned to locate the tannery. As in all other manufacturing industries, it is not only essential that the supply of labor be constant and be sufficient to meet all demands, but also that it should have some degree of aptitude for the work. It has been found that districts where trade spirit runs high yield a very desirable class of labor.

There are certain financial considerations which also play a part in the determination of a tannery location. A tannery, and especially a japannery, requires a large amount of land, which brings the initial cost to a high figure. The cost of land, therefore, is an important item to be considered. This applies with equal force to the surrounding land which is vacant and which may be needed later for expansion.

It is not requisite that a tannery be in the immediate vicinity of a good banking centre, for sufficient accommodation can be obtained if it is within a day's mailing distance of the bank.

A good supply of soft water is necessary for tanning purposes. It is also essential that the tannery wastes be carried off in a sanitary manner, either by the sewage system, or by disposition in a stream which does not have any immediate connection with the source of water supply.

Tannery Construction

Little attention seems to have been paid in the past to the most efficient methods of tannery construction, and the subject has but recently attracted any amount of serious attention.

Since the processes of tanning are practically continuous, the best layout for a tannery is one by which the material will move through in the straightest possible line. This problem has been met by one tannery by the construction of a U-shape building, with the railroad tracks passing the open end of the building; the raw material is brought in at one end of the building and the finished product is shipped out at the other end.

In general a single story building is desirable except for the space where the drying operations are performed, where multiple stories are necessary to give sufficient room. The warehouse is also of multiple stories, but need not be located at the tannery. It is common practice, indeed, in cases where the company is large enough, to have a warehouse in a leather distributing center, for the purpose of facilitating the purchase of leather by giving the purchaser an opportunity to examine the product.

Contrary to conditions in many other industries a tannery need have no special advertising value, and also need have no re-sale value. In cases where the tannery has a city warehouse, advertising value may be a necessary condition.

Tannery Equipment

The most fundamental consideration in the question of tannery equipment is the class of product to be manufactured and the method of tannage to be used. Equipment for a vegetable extract sole tannery is very different from a tannery producing light or upper leather by either vegetable or chemical tannages. In the latter case, the need of having the leather soft and pliable necessitates the use of much more machinery, and of a different class than that used for sole leather.

The use of machinery has a definite limit because of the fixed daily output of a tannery where vats are used in the tanning operations. In a sole leather tannery using vegetable extract, for instance, the vats will hold only a certain number of hides, resulting in the possible completion of only a definite number per day, viz. those which have passed through the previous processes. The same is true of the tannages where vats are not used, except that the output is slightly more elastic.

The amount of machinery used depends to a large extent on the class of product. Upper leather tanning, for example, is mainly done by machinery, the proportion of purely manual work being very small. Sole leather tanning, requiring the constant movement of hides from vat to vat, uses a larger percentage of manual labor.

II. Labor

Practically all the labor in a tannery is unskilled, the only exceptions being the foremen. The machine work which men are required to perform can be learned easily, and no high degree of intelligence is required of any of the laborers. Because of the simplicity of the processes, there is little effort made to train the workers systematically, new men being placed in a department and given instruction by the foreman.

Little welfare work is done by the tanners, as the men are in general well paid for the amount of labor required. This is again apparent from the small hold the unions have on tannery employees. Some attempts have been made to unionize tannery operatives, and the I. W. W. has also endeavored to spread its gospel among them, but without any noticeable effect. This is partly due to the satisfaction of tannery employees and partly to the mixture of nationalities, which does not make for homogeneity.

Tannery labor is usually very well satisfied, and consequently the labor turnover is not large. Men who leave the tanneries often go into shoe factories, but that tendency is decreasing, and the desire to remain a "tannery man" seems strong enough to hold most men to their jobs.

Since most of the labor of a tannery is unskilled, and consists in pushing trucks or running a simple machine, the rate of wages is not exceptionally high though it can not be said that the men are underpaid. Common laborers are generally paid about $2.25 a day, and workers on machines receive in the vicinity of $3.00 a day. The day rate is the method of payment in most cases, especially for common labor, but there is a tendency to put machine workers on a piece rate. Profit-sharing or bonus systems are not used in tanneries, as the industry does not seem to adapt itself to such methods.

The hours of labor vary in the great majority of cases from fifty-four to sixty hours per week, or 96.5% of the total, according to the census of 1909. There were practically no wage earners laboring over sixty

hours a week, and only 3.4% of the total under fifty-four hours. The limited amount of the daily output has a marked effect on the hours of actual labor. As has been explained above, only a definite number of hides can go through a tannery owing to the limited number of vats or drums and the impossibility of expediting the process. When this number of hides has gone through the tannery processes for one day, therefore, nothing remains to be done. Thus, though the specified hours of labor may amount to nine hours a day, it is quite certain that the actual working period will amount to a substantial reduction from that time, often as much as an hour or more. This shortened working period, together with the very fair wages give good reasons for a workman's desire to be a "tannery man."

I. By-Products

There are two main classes of by-products resulting from the tanning processes, (1) hair, and (2) fleshings and trimmings.

Hair comes from the process of unhairing the hides or skins, and may be put to many uses, as to stuff chairs, cushions, etc. The best white hair, moreover, is mixed with wool and commands a higher price than does the brown hair. After the unhairing process the hair is sorted according to colors and according to length, there being a difference in the length of the hair according to whether the hide was taken off in winter or in summer. It is usually sold to a middleman who collects and grades the hair before disposing of it to the manufacturer who needs such material.

Fleshings and trimmings come from the various fleshing and trimming processes, and are used in the manufacture of glue. The fleshings are collected, and sold directly to glue manufacturers without the intermediation of any dealer.

J. Financing

It must be apparent that the necessity of outside financing of tanners differs with the class of leather produced. Upper leather, for instance, can be manufactured in periods varying from three to six weeks, or more, allowing a turnover of product of five to six times a year. Sole leather, on the other hand, requires from one to six months for tanning, according to whether a chrome or a vegetable extract tannage is used, and in the latter case, which is the predominant way of tanning this product, the turnover can not be more than twice a year. Hence, a sole leather tanner is obviously in need of more working capital, which he is not always capable of furnishing himself.

Leaving aside differences in tannery products, and speaking of conditions in general, it is clear that the length of time necessary to put out the finished product in the tanning industry requires that the tanner be able to finance himself amply, or that he have some sure and ready source of capital outside his business. Especially is this true as regards purchases of hides and skins at certain seasons of the year, or even regularly over the whole year.

In estimating the character of the risk assumed in granting a line of credit to a tanner, the inventory of raw material, material in process, and finished product may be considered as first class current assets. There is always a ready market for the raw material and for the finished product, both of which can be disposed of at a little sacrifice. Material in process has a higher value than raw material, and has an increasingly

higher value every day it stays in the tannery. It does not seem, therefore, that a banker takes a risk of any large degree in considering inventory as a good basis for loaning.

When the tanner imports any or all of his raw material, the reasons for extending credit are reinforced on both sides; on the side of the tanner, who is called upon to finance himself for the extra period of shipment, and on the side of the bank which may protect itself in additional ways if necessary with the assurance that it is only a matter of time before that shipment of materials will be turned into cash. It is absolutely essential from the tanner's point of view that he finance his imports through a bank, especially if he buys most of his raw material at periodical auctions such as the Nizhni Fair, which comes once a year and makes an enormous call on his resources.

In this connection it is well to emphasize the arrangement often made with tanners by banks allowing them to renew their notes given on foreign or domestic shipment. At no increased risk, and with the realization that every day adds new value to the material on which the loan is based, the bank may renew the loan until the shipment for which it was extended has passed through the tannery, and has been converted into cash. The beneficial result on both the individual tanner and on the tanning industry is not hard to foresee if this practice is increased.

V. Leather Market

A. Organization

The largest market for leather in this country is Boston, which is the recognized center of the leather trade, not only for sole leather, but also for upper leather. The other main sole leather markets in order of relative importance are New York, Philadelphia, Chicago, and St. Louis. There are only two other very important upper leather centers, viz., New York and Chicago, although Philadelphia is recognized as the greatest center for glazed kid, or morocco. The reason for the predominance of Boston is its proximity to the greatest boot and shoe manufacturing district of the country, as well as because of the large tanning industry in eastern Massachusetts.

The main method of selling leather is by direct sale from the tanner to the manufacturer of leather products, practically ninety per cent of the leather being sold in that manner. The tanner himself does not always sell the leather, however, often organizing a separate company in which he has an interest to market his product.

The chart on page 53 will show the other methods of distributing leather. The jobber, or leather merchant, plays a large part in the marketing of leather which is not sold direct to the manufacturer. In some cases this merchant employs a commission man to aid in the purchase of leather, but this course is used in a very few cases. The manufacturer may also buy through a commission man, although this method also is used but little. The only other large domestic market for leather is the sole cutter, whose function is to cut sole leather into shapes readily usable by shoe manufacturers; he may sell his product direct to the manufacturer, or he may distribute through a findings jobber and findings retailer.

The foreign market for leather, like the foreign market for hides, is much more finely divided than the domestic market. There is a further complication in that the manufacturer of leather products is seldom in the market himself for leather, most of the trade being handled by "factors." These factors finance the shoe manufacturers and dispose of their products, somewhat as the American leather merchants do in the case of contract tanners. This arrangement makes the factors the largest purchasers of leather in the foreign market, except for large co-operative societies which do their own manufacturing.

The general organization of the foreign market is shown by the chart on page 51. The American end of the distribution of leather is handled by a jobber, a commission man, or the American representative of foreign factors. A few American tanners have resident selling agents in some of the foreign countries, but this is not the general custom. As has been stated, the factor is the main distributive agency on the foreign end, although some trading is done through commission men.

The terms of sale in the leather trade are very easy as compared with the terms of purchase of raw material. The following list will show the discounts allowed for prompt payment in the various classes of trade:

Sole leather	4%, 10 days; 3%, 30 days; 2%, 60 days;
Upper leather	5%, 10 or 30 days; 4%, 60 days;
Harness leather	2%, 30 days;

Fancy leather.....2%, 10 days; net, 30 days;
Book leather.....3% or 2%, 10 days;
Upholstery leather.....2%, 10 days.

In addition to the long discounts allowed in the sole leather and upper leather trade, it is the custom to give twenty days' antedating on practically all bills, thus giving the full discount for thirty days instead of ten. These discounts are rigidly adhered to in practice, and it is found that most customers take up the maximum discount. It is interesting to note that large and small purchasers receive identical treatment, no extra discounts for purchases of large quantities of leather being allowed.

The terms of sale on foreign purchases are from sight to ninety days' draft.

B. Domestic Market

The method of selling to domestic purchasers is, as has been stated, mainly by direct sale to the manufacturer. The sale may be consummated by the tannery office, by the selling office, or by traveling salesmen. In general, the principal way in which leather is sold is from the selling office of the tannery, located in some leather center. This is especially true if there is a warehouse in connection with the sales office, for many buyers prefer to examine the leather before closing a deal for its purchase. Salesmen are used to a large extent in creating a demand for the tannery's product.

The middleman plays an important part in the leather trade despite the comparatively small proportion of business done through him. The leather merchant, or wholesaler, is very useful to the tanner, or to the tanner's sale agency, in cleaning up job lots, and in taking off his shoulders the bother of catering to the small manufacturer of leather products. The merchant is willing to take greater credit risks, and since he specializes in the selling end of the trade, he can do this with greater safety. The commission man, acting as selling agent for the tanner, is also a significant factor in the leather trade. The main portion of his business is in selling at the leather centers for tanners who are located in other parts of the country. A great number of these commission men employ their excess capital by buying hides to be tanned on contract.

The tendency to cut out the middleman is not being felt strongly in the leather trade. This is due in great part to the fact that the tanners are already selling most of their product through their own agents, wherever it is possible, and what trade remains is either undesirable because of its size and credit risk or cannot be reached by direct means so advantageously.

Sales of leather do not show any marked seasonal fluctuation, the market being very steady the year round. The highest point in deliveries of leather usually comes around October, when shoe manufacturers are stocking up for their next run, and the low point comes in the spring, usually April. The effect of the shoe manufacturers' seasons does not seem to be felt greatly in the leather trade, due, no doubt, to the fact that although shoe factories must stock up for each new run, their demand for leather is practically continuous.

Advertising is not depended on to any great extent as a method of demand creation. Trade magazine advertisements are carried in large number by tanners and their selling agents, but rarely does the effort

extend beyond this, and it may be classed as general publicity advertising.

Shipments of leather are made from the tannery or warehouse, f. o. b. shipping point in practically all cases. Foreign shipments are also made under this rule.

Competition in the domestic leather market is very keen in most cases, verging at times on the cut-throat variety among some dealers. There is no dominating factor in the market, although it is estimated that the United States Leather Company controls about 40% of the output of sole leather, and a few other tanners control another 20% of this trade. The market is so open, however, that no ruling influence can be exercised by any one concern, as a buyer can readily find a market elsewhere if he discovers an attempt to control prices or supply. Another factor making for an open market is the umbrella policy of the United States Leather Company, which endeavors to keep the small independent in business rather than forcing him to the wall, since the operations of a large number of small dealers tends to steady and strengthen the leather market, rather than causing marked rises and falls on a false basis.

C. Foreign Market

Our largest markets for sole leather and for glazed kid upper leather exports are shown by the charts on pages 55 and 56. The United Kingdom is seen to be our greatest foreign market for sole leather by a wide margin, although doubtless much of this leather is for re-export. In ordinary times Japan takes about as much leather as the remaining countries of Europe combined. (See Appendix C.)

In imports of our glazed kid leather the United Kingdom again leads all other nations by a wide margin. Germany and Netherlands are ordinarily large importers of this class of leather, and the remainder of Europe is a good market. This condition reflects great credit on our upper leather tanning industry, for we lead the world in producing goatskin and kid leather.

The main competition in our foreign trade comes from Germany and Austria, which are large producers of sole and upper leather. Present conditions, of course, have absolutely eliminated all such competition, which accounts for the rapid increase of exports of leather—amounting to an increase of over 43% during 1915 and 1916, for sole leather and 30% for glazed kid. The possibilities of holding the increased foreign trade after the close of the war do not look very hopeful because of the strong competition bound to come from the central empires as soon as they are able to procure a sufficient supply of raw material, and to satiate their domestic demand.

D. Sole Cutting

There is one division of the market for leather which has not been described as yet, and which is becoming of increasing importance—the sole cutting business. The function of this branch of the leather industry is to cut leather into shoe soles of various sizes and grades, and to distribute them to shoe manufacturers, which serves to fill the need of the manufacturer of a special kind of product requiring only a few grades of leather.

No figures are obtainable on the extent of this business, but it is known that it is steadily increasing. There is a noticeable tendency, furthermore, for tanners to take on these operations to provide a dependable outlet for their product and, of course, to reap the benefit of any additional profit. This field is primarily suited for large tanners whose product is diverse, for they may cut a large assortment of grades of soles, but the small tanner is by no means prevented from establishing a sole-cutting department, as he may specialize in selling one or two grades of cut soles.

E. Substitutes for Leather

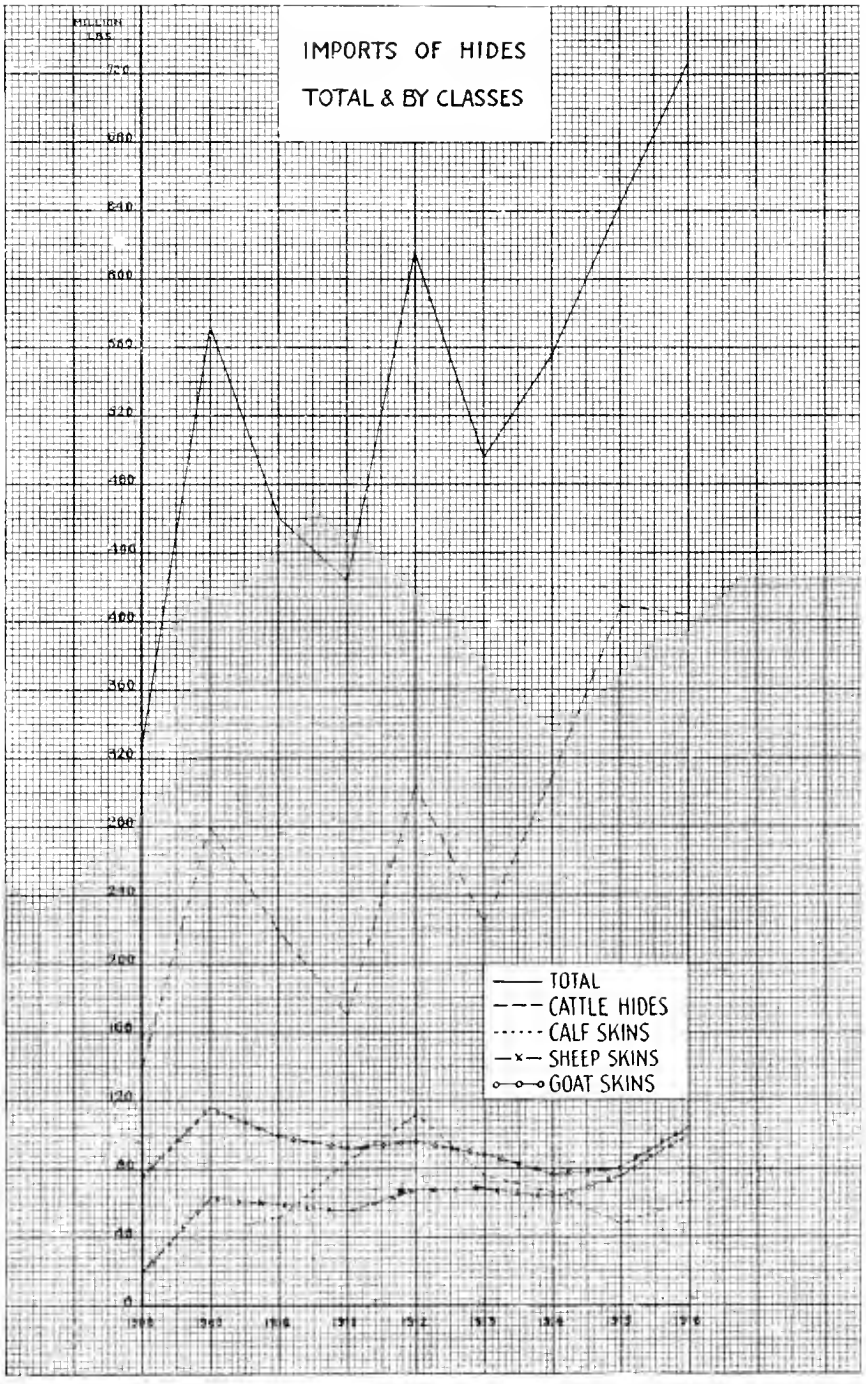
There has been a tendency in recent years to strive to find substitutes for leather, due primarily to the rise in prices for the tanners' product. Since the start of the European war this inclination has been strongly emphasized until at the present time substitutes for leather are in very general use. These substitutes are of two general classes, corresponding to the classes of leather:

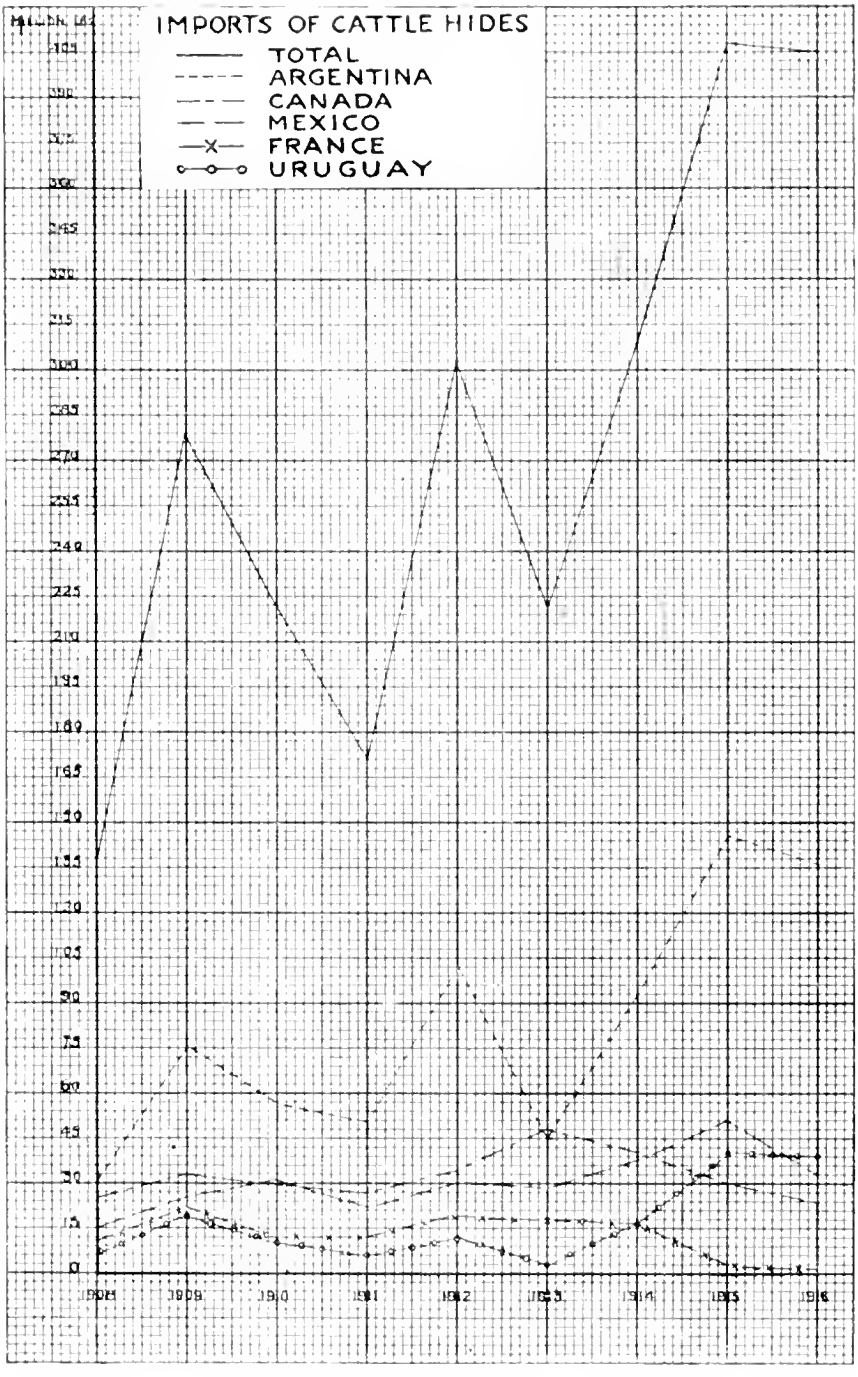
(1) substitutes for sole leather,
(2) substitutes for upper leather.

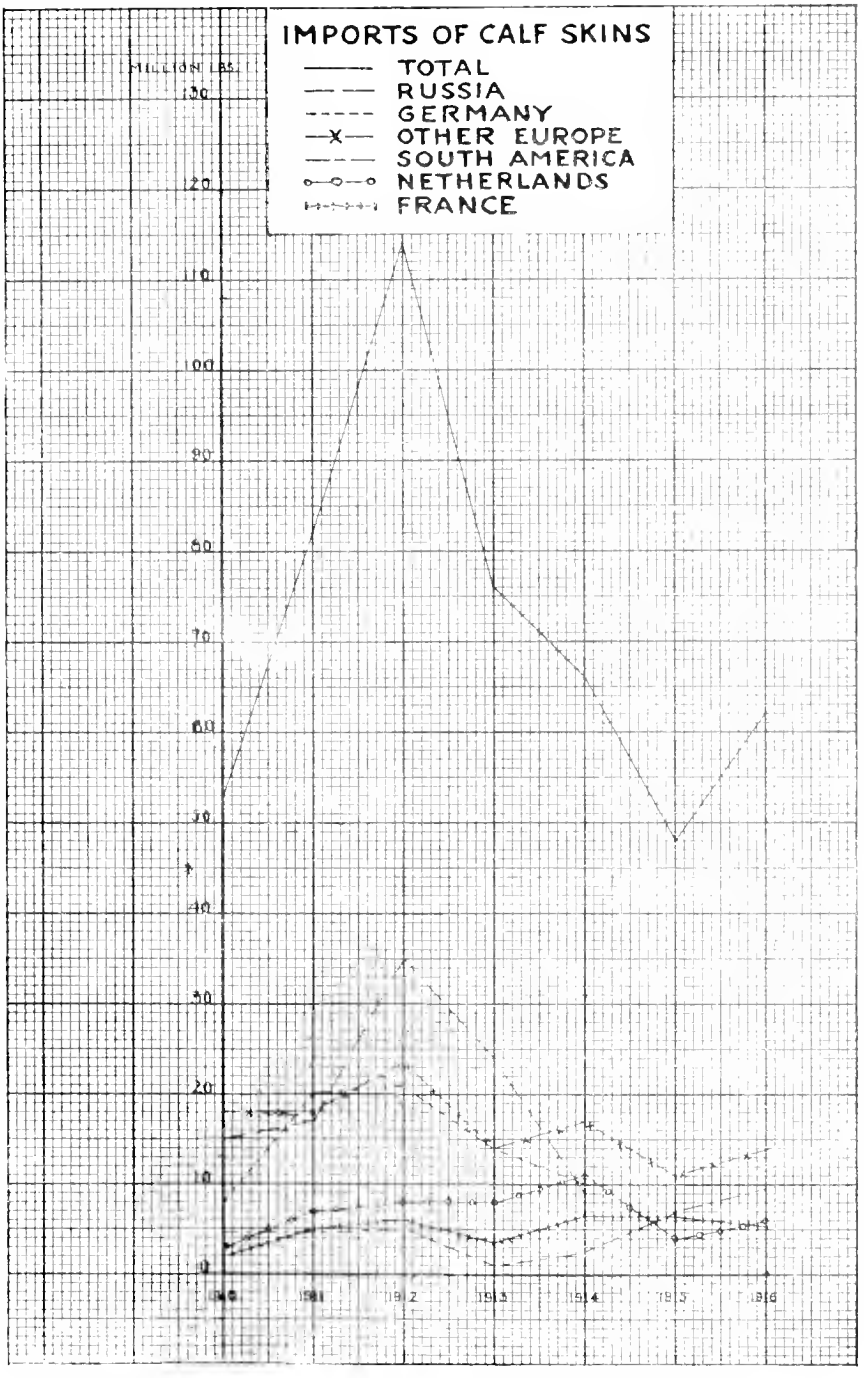
The principal substitutes for sole leather include rubber, and a composition material of leather and rubber; the chief substitute for upper leather is cloth. Rubber is a widely used substitute for leather, but its use is due more to desire for additional comfort rather than because of reasons of expense. The composition sole material has come on the market only recently, and seems to be filling a real need at the present time because of its comparative inexpensiveness. The question of its relative worth brings forth widely different claims, but it is the general opinion that this material will outwear leather if it wears evenly. The difficulty is that the substitute sole is liable to crack under extreme heat or cold, whereas leather seems to have a porousness which allows it to suit itself to differing conditions of temperature and humidity.

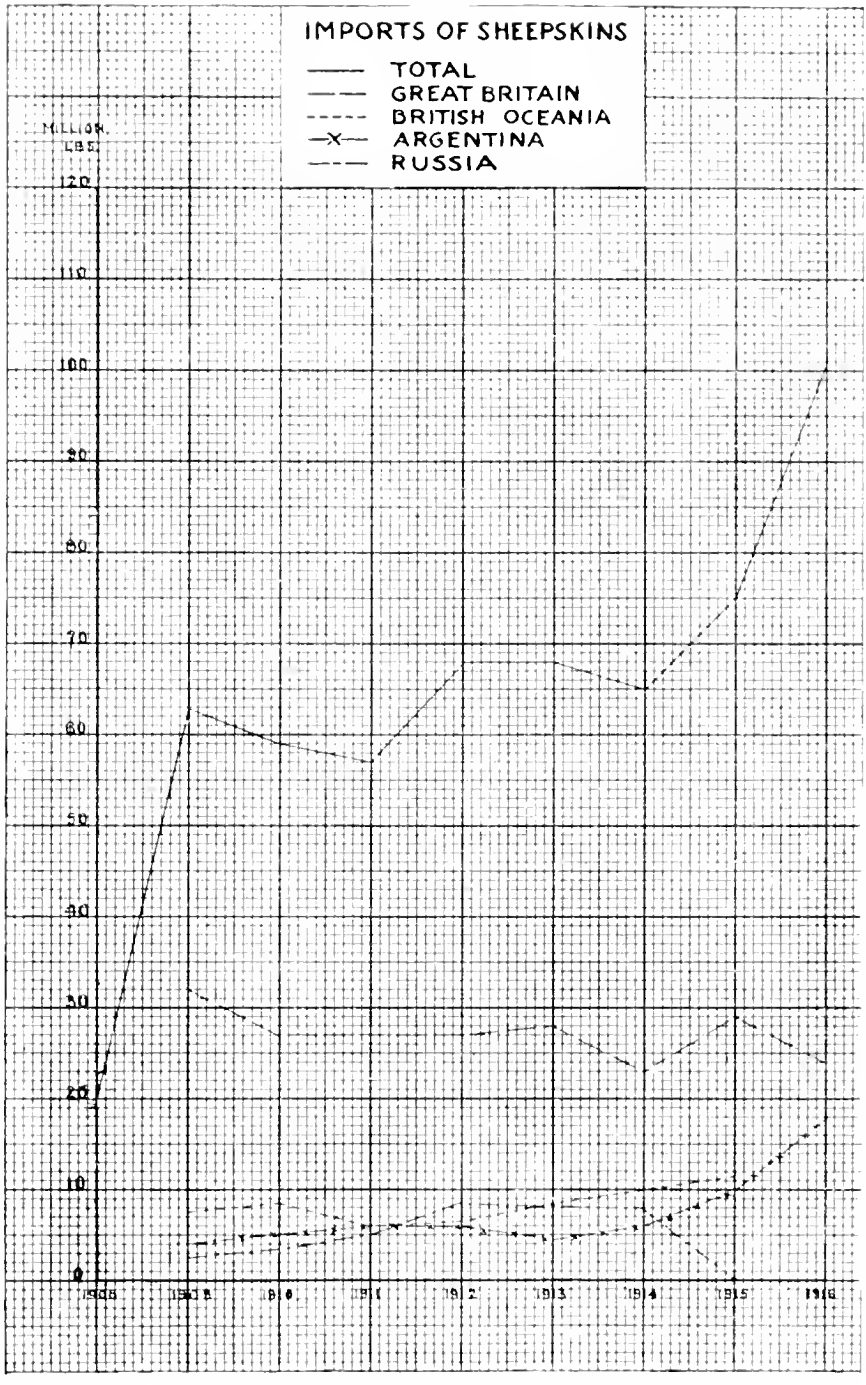
The chief substitute for upper leather, cloth, can not be judged entirely on the grounds of intrinsic value because of the fact that there is no small degree of style element involved in its use. Where this condition obtains, such a substitute may well be as popular in times of low leather prices as in times when leather demands a high price, since style is the overwhelming reason for its use.

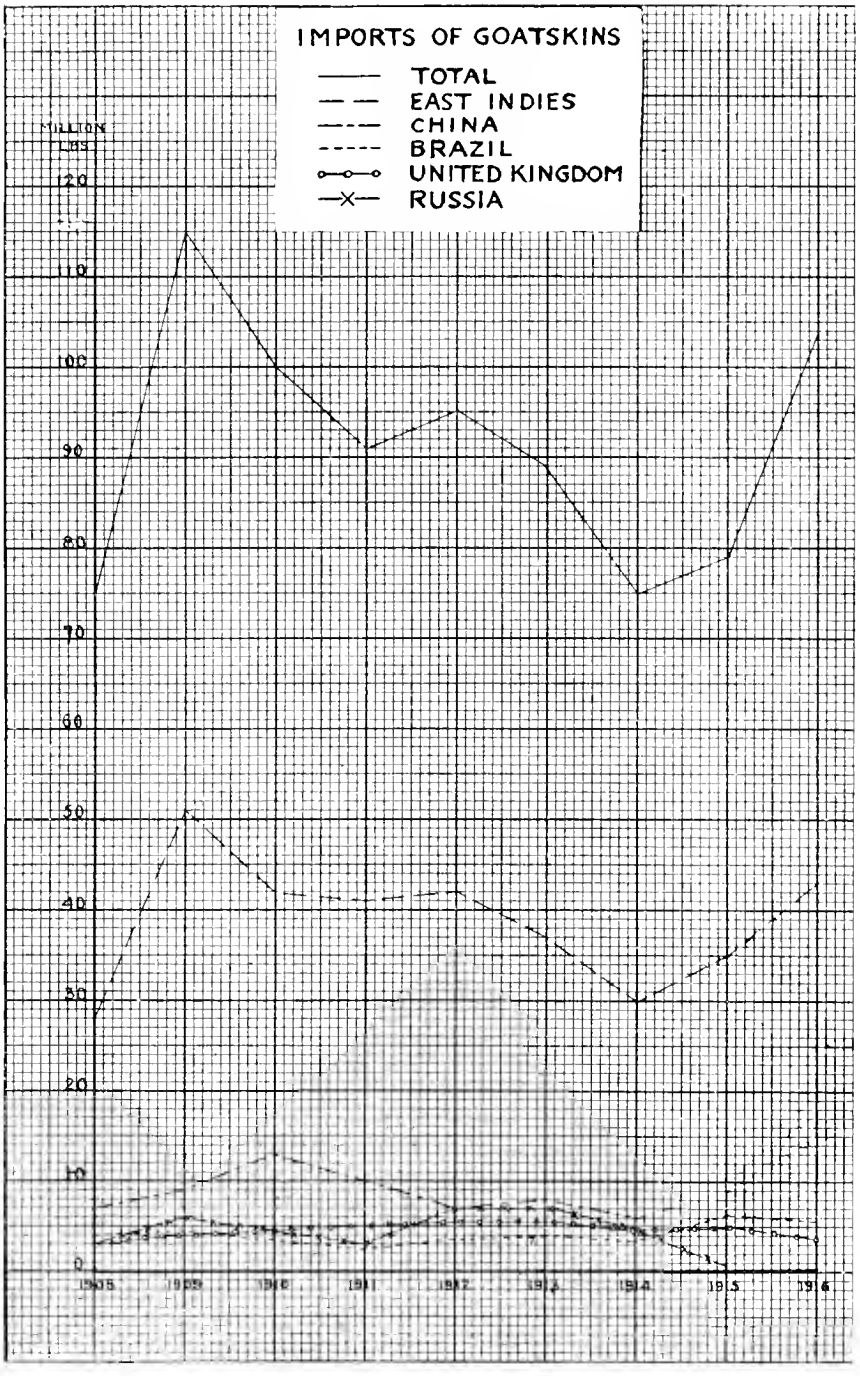
The competition from these substitutes has been keen during the past few years and will undoubtedly continue to be of such extent for the period of the war and immediately afterwards, or, in a word, while leather prices remain high. The present scale of prices is forming an umbrella under which substitutes are readily salable, but when leather prices slump, and the margin between them and substitute prices decreases, the competition of the substitutes will be felt more severely. It is foolish to suppose that these substitutes as composed at present can ever take the place of leather, but as a supplement to leather they undoubtedly have a large field. Their influence now is most beneficial, as it serves to steady the leather market and to prevent leather prices from climbing to even more lofty heights.


IMPORTS OF HIDES
TOTAL & BY CLASSES
TOTAL
CATTLE HIDES
CALF SKINS
SHEEP SKINS
GOAT SKINS

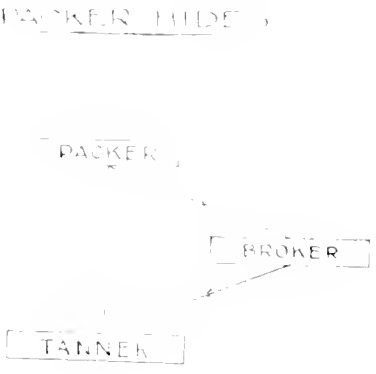

IMPORTS OF CATTLE HIDES
TOTAL
ARGENTINA
CANADA
MEXICO
FRANCE
URUGUAY
1908
1909
1910
1911
1912
1913
1914
1915
1916


IMPORTS OF CALF SKINS
TOTAL
RUSSIA
GERMANY
OTHER EUROPE
SOUTH AMERICA
NETHERLANDS
FRANCE
MILLION LBS.
120
110
100
90
80
70
60
50
40
30
20
10
0
1910
1911
1912
1913
1914
1915
1916


IMPORTS OF SHEEPSKINS
TOTAL
GREAT BRITAIN
BRITISH OCEANIA
ARGENTINA
RUSSIA
MILLION LBS.
120
110
100
90
80
70
60
50
40
30
20
10
0
1908
1909
1910
1911
1912
1913
1914
1915
1916

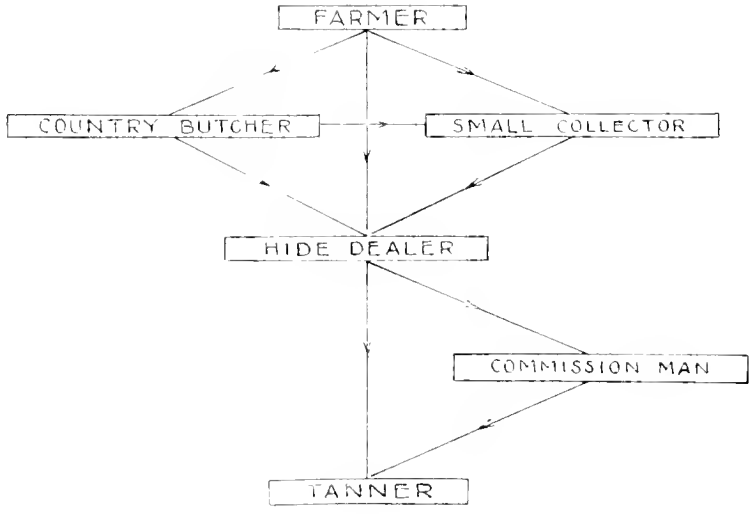

IMPORTS OF GOATSKINS
TOTAL
EAST INDIES
CHINA
BRAZIL
UNITED KINGDOM
RUSSIA
MILLION LBS
120
110
100
90
80
70
60
50
40
30
20
10
0
1905
1909
1910
1911
1912
1913
1914
1915
1916

ORGANIZATION OF THE DOMESTIC MARKET

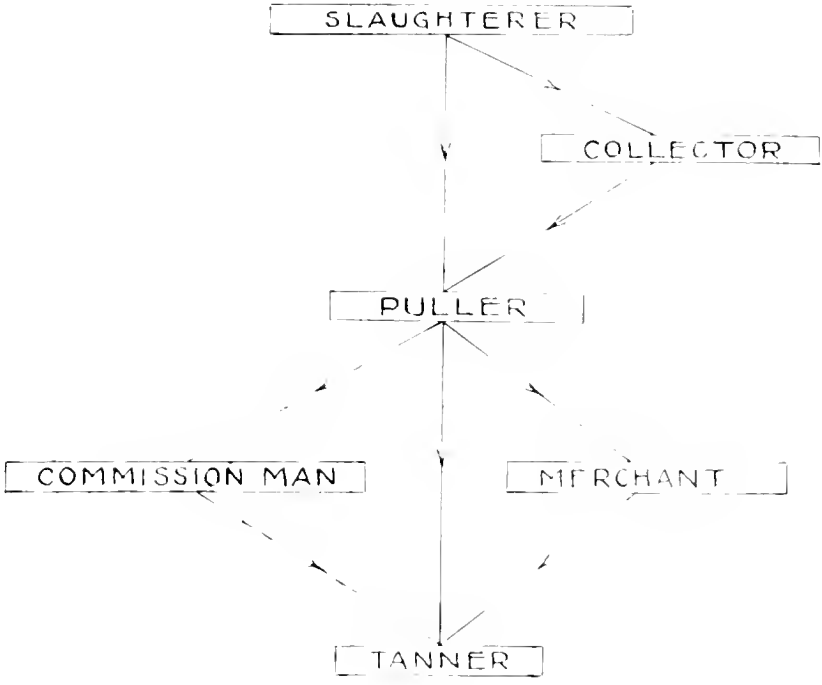


ORGANIZATION OF THE DOMESTIC MARKET CONTINUED

COUNTRY HIDES

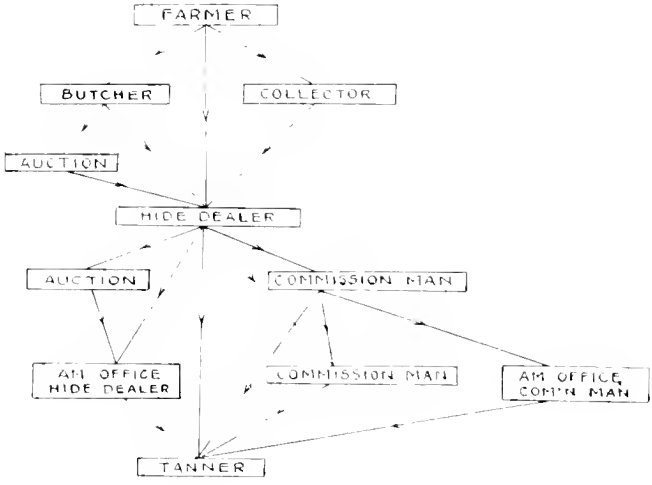


ORGANIZATION
OF THE
DOMESTIC SHEEPSKIN MARKET

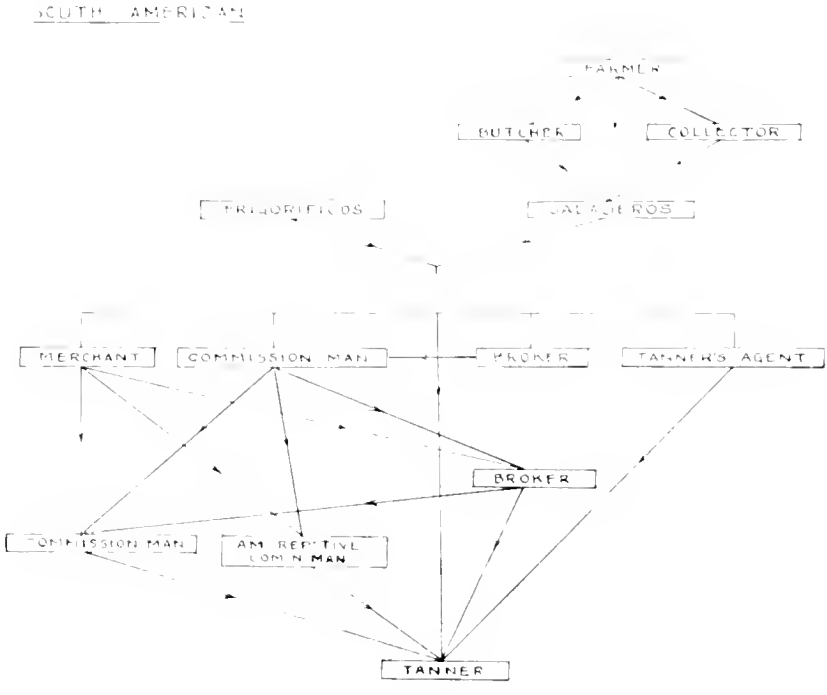


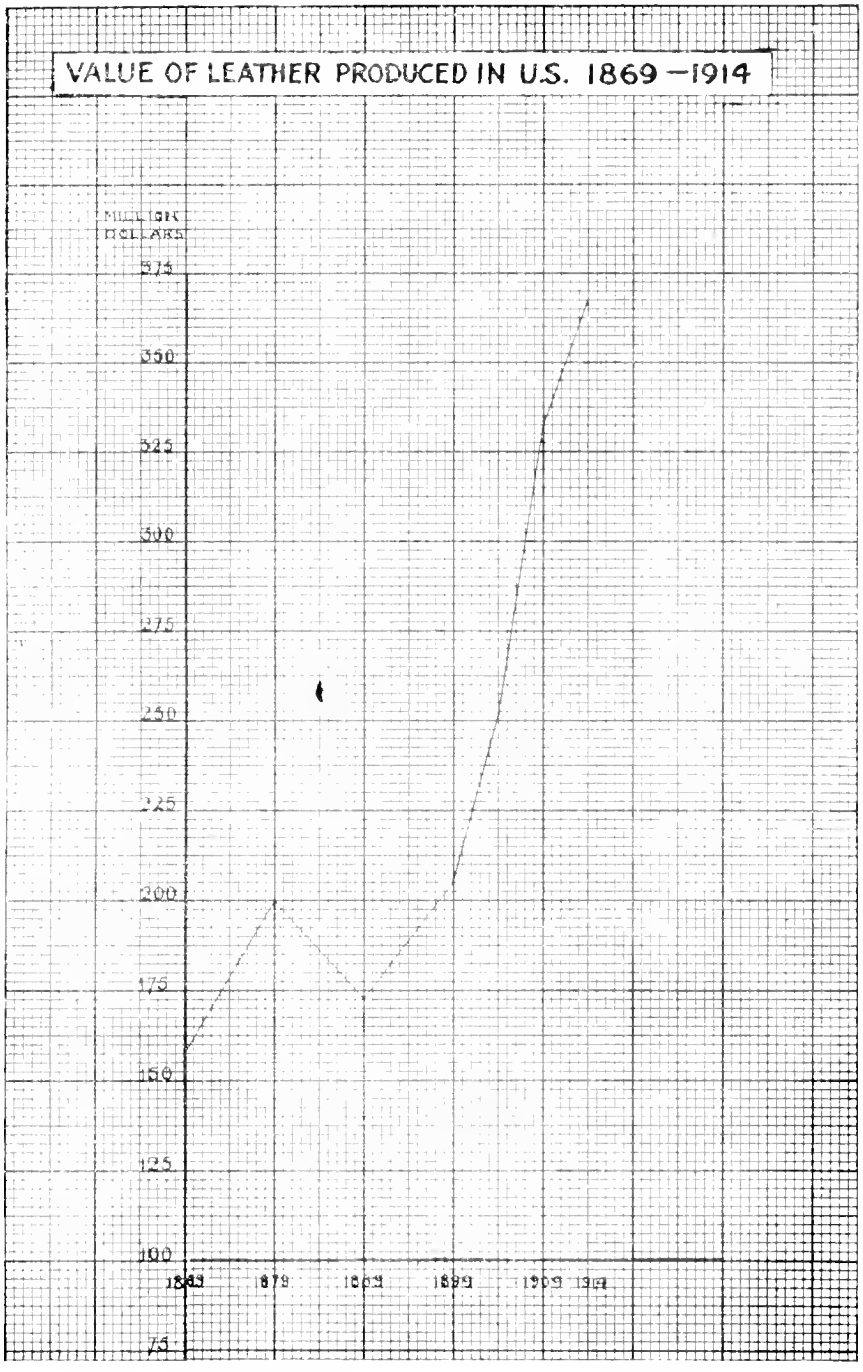
ORGANIZATION OF FOREIGN HIDE MARKETS

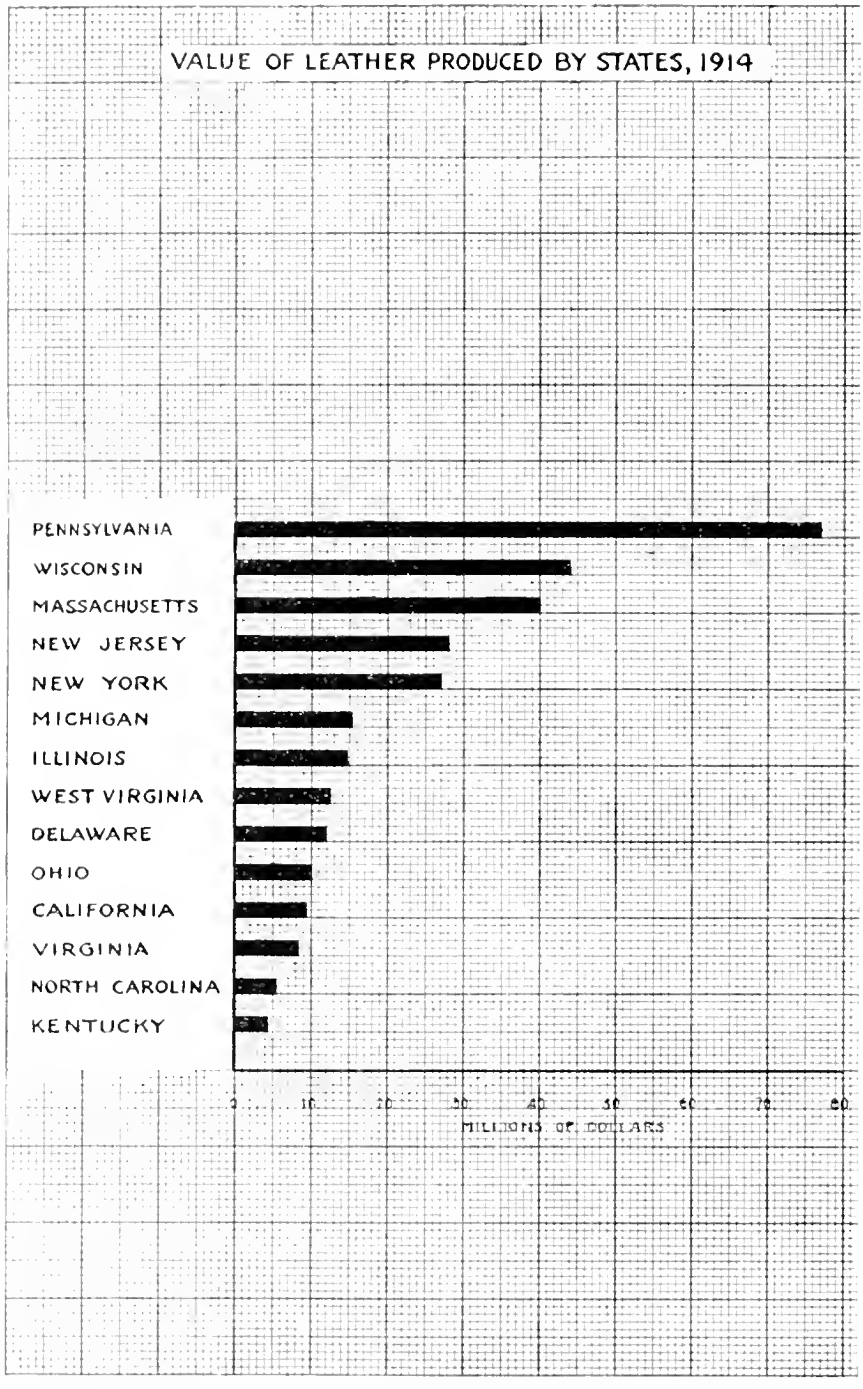
EUROPEAN



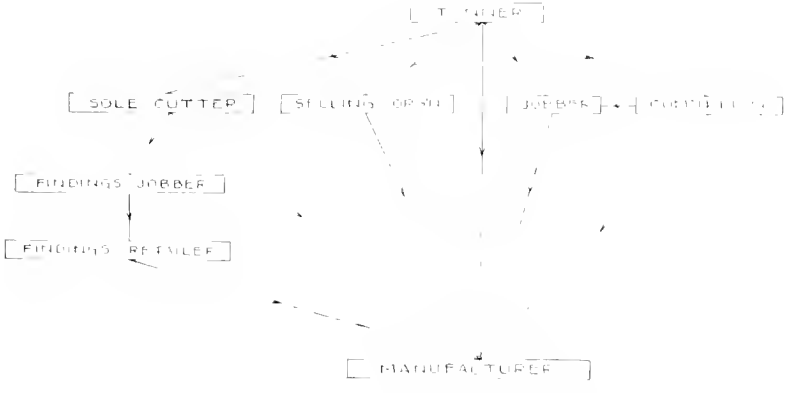
ORGANIZATION OF FOREIGN HIDE MARKETS CONTINUED



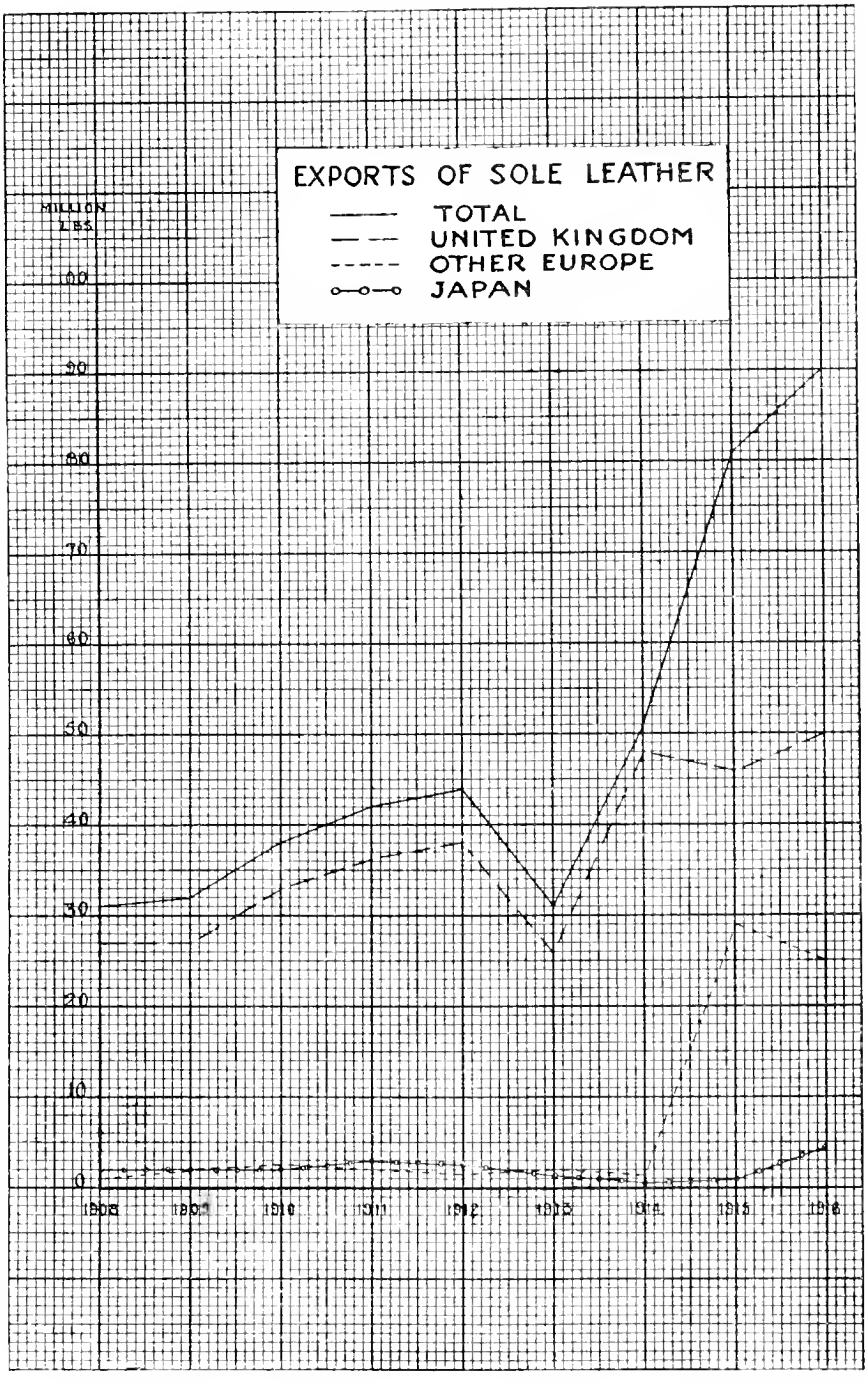

VALUE OF LEATHER PRODUCED IN U.S. 1869—1914
MILLION DOLLARS
375
350
325
300
275
250
225
200
175
150
125
100
75
1869
1879
1889
1899
1909
1914


VALUE OF LEATHER PRODUCED BY STATES, 1914
PENNSYLVANIA
WISCONSIN
MASSACHUSETTS
NEW JERSEY
NEW YORK
MICHIGAN
ILLINOIS
WEST VIRGINIA
DELAWARE
OHIO
CALIFORNIA
VIRGINIA
NORTH CAROLINA
KENTUCKY
0
10
20
30
40
50
60
70
80
MILLIONS OF DOLLARS

ORGANIZATION OF THE DOMESTIC LEATHER MARKET



ORGANIZATION OF THE FOREIGN LEATHER MARKET


EXPORTS OF SOLE LEATHER
TOTAL
UNITED KINGDOM
OTHER EUROPE
JAPAN
MILLION LBS.
80
70
60
50
40
30
20
10
0
1908
1909
1910
1911
1912
1913
1914
1915
1916

EXPORTS OF UPPER LEATHER — KID
TOTAL
UNITED KINGDOM
GERMANY
NETHERLANDS
OTHER EUROPE
MILLION SQ. FT.
110
100
90
80
70
60
50
40
30
20
10
0
1910
1911
1912
1913
1914
1915
1916

Appendix A

Appendix B

Appendix C

Appendix A

Imports

Total a

	1908 Lbs.	1909 Lbs.	1910 Lbs.	1911 Lbs.
Total	328,446,882	572,776,503	460,607,078	424,876,678
Cattle Hides	137,922,575	279,044,262	221,969,098	170,649,238
Calfskins		47,062,988	53,157,553	82,631,186
Sheepskins	20,138,987	63,711,930	59,669,263	57,434,466
Goatskins	75,857,983	115,167,176	100,719,480	91,064,556
	Since July 1			

Imports of Cattle Hic

Argentina	30,097,803	75,716,335	57,534,654	50,046,899
Canada	25,564,022	32,375,820	29,955,538	27,818,650
Mexico	15,024,716	25,389,620	31,633,682	22,259,302
France	10,365,000	22,261,677	12,196,842	12,688,160
Uruguay	8,269,637	23,954,701	14,284,726	6,518,688

Imports of Calfski

Russia			15,387,689	17,266,289
Germany			8,735,764	20,697,377
Netherlands			3,018,501	7,372,601
France			2,262,744	4,962,412
Other Europe			18,047,073	18,429,558
South America			4,750,308	4,673,520

Hides and Skins

By Classes

1912 Lbs.	1913 Lbs.	1914 Lbs.	1915 Lbs.	1916 Lbs.
615,105,439	497,879,316	556,194,541	646,271,307	727,010,405
303,530,775	223,564,715	308,050,216	408,632,111	404,901,341
114,859,364	76,454,032	66,915,534	48,914,776	62,657,181
68,230,511	68,205,805	65,943,961	75,086,576	101,530,219
95,323,388	89,677,275	75,855,063	79,287,484	104,226,005

by Principal Countries

101,241,806	45,243,705	93,986,530	145,414,537	136,285,332
34,411,348	48,011,196	40,351,186	30,576,663	24,998,659
30,712,246	28,457,714	37,750,732	50,808,523	32,374,236
19,727,143	17,792,387	16,376,786	3,315,144	1,882,552
12,414,648	3,398,522	16,722,951	40,051,832	39,905,328

by Principal Countries

35,618,531	24,329,173	9,368,067		
21,771,692	14,189,723	10,592,526		
8,494,641	8,322,114	11,313,504	4,428,407	6,557,310
6,243,197	3,706,051	6,494,750	6,632,629	5,726,937
23,724,798	14,067,790	17,386,087	11,525,627	14,079,800
5,060,281	1,156,199	2,690,292	7,291,488	9,538,148

Appendix A—Continued

Imports of Hides and Skins

Imports of Sheepskir

United Kingdom		32,272,834	27,839,190	27,500,830
Russia		2,634,250	3,518,556	4,812,119
Br. Oceania		7,495,275	8,444,966	6,051,497
Argentina		4,261,522	4,999,931	5,857,612

Imports of Goatskir

East Indies	28,136,982	51,590,855	42,500,600	41,797,305
China	7,121,813	9,540,407	13,072,066	10,066,201
Brazil	4,073,443	4,256,816	3,651,088	2,818,571
United Kingdom	3,238,923	4,359,906	4,734,652	5,196,655
Russia	3,607,616	5,899,312	4,420,607	3,256,961

by Principal Countries

27,709,604	28,563,976	23,608,815	29,273,143	24,897,795
8,557,617	7,730,534	7,197,696	22,840	
6,705,597	8,626,973	9,960,855	11,689,728	
6,368,068	4,547,911	6,753,032	10,157,619	17,987,619

by Principal Countries

42,448,889	37,575,746	30,260,161	35,579,480	43,597,174
7,266,489	8,406,743	6,916,607	9,589,951	15,384,557
3,772,538	3,998,172	3,465,847	6,256,859	5,400,122
5,564,716	5,595,240	4,837,778	5,131,795	3,845,270
7,282,897	6,845,757	4,647,884	48,180	

Appendix B

Tanneries and Leather Production by Principal States, 1909

	No. Estab.	Wage Earners			Value of Products		
		Av'ge No.	%	Rank	Amount	%	Ra
Pennsylvania	163	14,008	1		$77,926,321	23.8	1
Wisconsin	32	7,548	3		44,667,676	13.6	2
Massachusetts	132	10,252	2		40,002,079	12.2	3
New Jersey	86	5,560	5		28,430,955	8.7	4
New York	109	5,688	4		27,642,383	8.4	5
Michigan	24	2,291	8		15,331,104	4.7	6
Illinois	29	3,001	7		14,911,782	4.5	7
West Virginia	20	1,571	11		12,450,592	3.8	8
Delaware	16	3,045	6		12,079,225	3.7	9
Ohio	36	1,884	9		10,127,836	3.1	10
California	40	1,398	12		9,336,545	2.9	11
Virginia	39	1,590	10		8,266,850	2.5	12
North Carolina	39	832	13		5,415,495	1.7	13
Kentucky	18	630	14		4,240,795	1.3	14

Appendix C

Exports

Exports of

	1908 Lbs.	1909 Lbs.	1910 Lbs.	1911 Lbs.
United Kingdom	27,330,224	27,453,801	33,014,945	36,485,637
Other Europe	1,296,574	2,032,135	2,445,376	2,119,325
Japan	2,203,945	2,144,574	2,011,435	2,869,142

Exports of Upper

	1908 Sq. Ft.	1909 Sq. Ft.	1910 Sq. Ft.	1911 Sq. Ft.
United Kingdom			2,536,596	39,776,473
Germany			594,614	12,014,927
Netherlands			797,687	10,180,861
Other Europe			1,085,537	14,750,321
	Since July 1			

Exports of Upper

	1908 Sq. Ft.	1909 Sq. Ft.	1910 Sq. Ft.	1911 Sq. Ft.
Total			4,263,399	7,987,354
	Since July 1			

of Leather

Sole Leather

1912 Lbs.	1913 Lbs.	1914 Lbs.	1915 Lbs.	1916 Lbs.
38,150,837	26,588,513	48,070,485	46,584,175	50,754,672
1,851,416	2,150,554	1,466,828	29,441,458	25,606,541
2,642,771	1,322,553	589,406	1,190,848	4,721,026

Leather—Kid

1912 Sq. Ft.	1913 Sq. Ft.	1914 Sq. Ft.	1915 Sq. Ft.	1916 Sq. Ft.
47,297,131	39,486,018	39,425,207	45,694,124	52,313,361
14,374,556	15,410,380	7,239,688		
10,325,473	8,138,722	3,835,742	7,130,799	6,593,583
14,943,414	13,835,658	11,290,401	24,638,671	27,354,458

Leather—Calfskins

1912 Sq. Ft.	1913 Sq. Ft.	1914 Sq. Ft.	1915 Sq. Ft.	1916 Sq. Ft.
8,377,525	9,576,669	7,162,956	14,896,591	21,226,840

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